Chapter Seventeen ◆ Water Resources and Flood Risk

INTRODUCTION

17.1 This chapter of the Environmental Statement (ES) assesses the likely environmental effects of the Proposed Development with respect to water resources and flood risk. This chapter also describes the methods used to assess the effects, the baseline conditions existing at the Project Site and surrounding area, the mitigation measures required to prevent, reduce or offset any significant adverse effects, and the likely residual effects after these measures have been adopted. This chapter was originally published in December 2020 but has since been updated (July 2021) to reflect the notification of the Swanscombe Peninsula as a SSSI.

17.2 This chapter covers matters relating to a number of different aspects of water resources and the water environment. These include:

- Flood risk management;
- Surface water drainage;
- Foul drainage;
- Water resource management;
- Water quality and commitments to the water framework directive (WFD); and
- Coastal processes and hydromorphology in the context of marine infrastructure.

17.3 The chapter considers water resources and flood risk at both the Kent Project Site which includes the main resort and access corridor, and the Essex Project Site at the Port of Tilbury.

17.4 A Flood Risk Assessment (FRA) and a Drainage Strategy covering both the Kent and Essex Project Sites have been prepared in accordance with the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government (MHCLG), 2019) and consultation with the Environment Agency (EA), Kent County Council (KCC), Thurrock Council (TC) and Essex County Council (ECC). The FRA and Drainage Strategy covering both the Kent and Essex Project Sites accompany this chapter as Appendices 17.1 (document reference 6.2.17.1) and 17.2 (document reference 6.2.17.2) respectively. The Drainage Strategy (document reference 6.2.17.2) provides information on how surface water from the Proposed Development will be managed to ensure existing surface water

management and flood risk are not compromised.

17.5 A programme of water sampling is being undertaken and initial results can be found in Appendix 18.20 *Buro Happold (2021) London Resort Water environment – interim monitoring report* (Document Ref. TBC)~~Appendix 17.3 Surface Water Quality Testing (document reference 6.2.17.3)~~. Hydrodynamic modelling has also been carried out with an assessment of effects presented in Appendix 17.4 Hydrodynamic and Sedimentation Assessment (document reference 6.2.17.4).

17.6 Appendix 17.5 (document reference 6.2.17.5) comprises the comments that came back from the EIA Scoping process and from review of the Preliminary Environmental Information Report (PEIR), which was submitted as part of the statutory DCO application process. This appendix includes responses detailing where and how the comments have been addressed.

17.7 In relation to water quality, a Water Framework Directive (WFD) assessment (document reference 6.2.13.7) has been prepared. The WFD assessment supports the DCO application as a stand-alone document (document reference 6.2.13.7) and is appended to Chapter 13 Marine Ecology and Biodiversity (document reference 6.1.13).

17.8 A separate assessment of the potential effects on groundwater resources and groundwater quality is provided in Chapter 18 'Soils, hydrogeology and ground conditions' (document reference 6.1.18). A summary of existing conditions relating to groundwater will also be provided within this chapter, primarily to identify the links between groundwater and surface water effects. Aquatic ecological issues are also addressed separately in Chapter 12 'Terrestrial and freshwater ecology and biodiversity' and Chapter 13 'Marine ecology and biodiversity' (document reference 6.1.13).

METHODOLOGY AND DATA SOURCES

EIA Scoping

17.9 A formal request for a scoping opinion was submitted to the Secretary of State (SoS) in June 2020. The water resource-related responses that resulted from the scoping process are presented in Appendix 17.5 Water Resource and Flood Risk Stakeholder Responses (document reference 6.2.17.5) which includes information indicating how responses have been covered in the scope of the assessment and supporting appendices.

Consultation

17.10 Consultation is ongoing with the Environment Agency (EA), Essex County Council (ECC), Thurrock Council (TC), Kent County Council (KCC), Thames Water (TW), Southern Water (SW), Anglian Water (AW), Essex and Suffolk Water (ESW), Uber Boat by Thames Clippers (TC), Port of Tilbury (PoT), Port of London Authority (PLA) and the Marine Management

Organisation (MMO). Tables 17.1 to 17.4 summarise the recent consultation that is relevant to the water resources and flood risk chapter.

Table 17.1: List of recent consultation undertaken relevant to flood risk and drainage.

Stakeholder	Consultation date	Comment
Environment Agency (EA)	27/03/2020	Introductory call
~~Environment Agency~~EA	23/06/2020	Consultation with the EA with regard to flood risk for both the Kent and Essex Project Sites.
Anglian Water	25/06/2020	Discussion regarding drainage at Essex Project Site.
Thurrock Council	10/07/2020	Discussions relating to: Lead Local Flood Authority (LLFA) role and Essex County Council support; siltation in East Tilbury Dock Sewer; operation of the sluice valve; and limited capacity of surface water drainage in the area.
~~Environment Agency~~EA and Kent County Council	04/08/2020	Agreement on drainage principles relating to: unrestricted discharge; drainage strategy, outfalls and marsh outfalls (for Kent Project Site)
Essex County Council	25/09/2020	Presentation of proposed drainage strategy, and discussion regarding: unrestricted discharge; climate change allowance used; incorporation of green roofs and treatment they provide
EA	02/06/2021	Meeting to discuss the comments provided in their Relevant Representation with regard to flood risk, contaminated land, biodiversity, geomorphology and surface water and agree an approach for consultation going forward
EA	16/06/2021	Follow-up to discuss their comments provided from the Relevant Representations with regard to flood risk

Table 17.2: List of consultation undertaken relevant to water quality and WFD.

Stakeholder	Consultation date	Comment
Environment Agency	09/07/2020	Consultation with the EA with regard to water quality and WFD. Continued consultation with EA via email.

SW	16/06/2020	Discussion regarding treatment of wastewater from Kent Project Site.

Table 17.3: List of consultation undertaken relevant to potable and foul water.

Stakeholder	Consultation date	Comment
Thames Water	03/04/2020 22/09/2020 29/09/2020 01/10/2020 02/10/2020 13/10/2020 11/11/2020	Discussions regarding demand estimation and supply of potable water to Kent Project Site.
SW	16/06/2020 22/07/2020 27/08/2020 11/11/2020	Discussion regarding treatment of wastewater from Kent Project Site.

Table 17.4: List of consultation undertaken relevant to marine infrastructure.

Stakeholder	Consultation date	Comment
Uber Boat by Thames Clippers and Port of Tilbury	03/04/2020	Discussion regarding proposals at the Kent and Essex Project Sites.
Port of London Authority (PLA)	06/04/2020	Discussion regarding navigation aspects at the Kent and Essex Project Sites.
PLA	19/06/2020	Further discussions regarding marine strategy at Kent and Essex Project Sites.
Marine Management Organisation (MMO)	02/07/2020	Discussion regarding marine strategy and requirements at the Kent and Essex Project Sites.
~~Port of London Authority~~PLA	05/08/2020	Outline meeting to discuss key risks associated with proposals and agree outline and process required for the Navigational Risk Assessment
Port of Tilbury	28/09/2020	Meeting to discuss proposed layout for landing stage on the Essex Project Site
~~Port of London Authority (PLA~~PLA~~)~~, London Resort, Thames Clippers and Port of Tilbury	06/10/2020	Navigational Risk Assessment workshop held with all parties to establish all key navigational risks associated with the Kent and Essex Project Sites and associated marine transport strategy.
~~Port of London~~	07/12/2020	Discussion re. outputs of NRA previously

~~Authority (~~PLA~~)~~		provided by PLA & to set out approach to collaborate through the DCO process
PLA	22/04/2021	BH & NASH - London Resort - Navigation Risk Assessment - Phase 1 review
PLA	16/06/2021	BH & NASH - Navigation Risk Assessment Stakeholder Engagement with the PLA

Study area and scope

17.11 The spatial area this assessment covers includes all resources associated with water quality within the application boundary. This includes surface water bodies (lakes, rivers, marshes, ponds etc.), and water services infrastructure capacity.

17.12 It also includes offsite receptors that have the potential to be directly or indirectly affected by construction and operation of the Proposed Development, for example surrounding areas of the River Thames, any other water bodies in close vicinity or hydrologically linked to the Project Sites, and any offsite water services infrastructure that is proposed to service the Project Sites. Potential impacts on the hydromorphology of the River Thames at this stretch of the river have also been assessed.

17.13 Flood risk both on-site and off-site is assessed as is the risk to site users (construction workers and operational users). The flood risk extent considered (that has the potential to be affected) at the Kent Project Site covers an area approximately south to the A2, along the access corridor and east to Gravesend. The flood risk extent that may be affected at the Essex Project Site is approximately between Grays and Linford covering the area of Tilbury.

17.14 Matters relating to groundwater are assessed in Chapter 18 'Soils, hydrogeology and ground conditions' (document reference 6.1.18).

Baseline study methodology

17.15 The baseline assessment covers the Project Site and surrounding areas that may impact the Proposed Development or be susceptible to impact as a result of the Proposed Development; this includes major water bodies (i.e. the River Thames and River Ebbsfleet) within a material distance of the Project Site, as deemed by the assessment author. As described above, this includes all water resources within the application boundary, but does not prescribe a specific buffer distance outside that for inclusion, rather it looks at where there are hydrological links. This could mean nearby surface water bodies but could also include water infrastructure (e.g. wastewater treatment works (WWTW) further afield).

17.16 The baseline review will take into account the following baseline scenarios:

- existing baseline, or the assessment baseline (conditions in 2020 – when the assessment is made); and
- future baseline (conditions in 2029 – the first year of full operation).

17.17 It should be noted that the future baseline accounts for how existing baseline conditions could change by the year of completion in the absence of the Proposed Development and is referred to as the 'Do Nothing' scenario.

17.18 The methodology adopted in this assessment involves the following:

- review of international, national and local legislation, policies and guidelines in relation to water resources, water quality and flood risk;
- establishment of baseline conditions on and around the Project Site through literature review and analysis of existing data obtained from the EA and TW, AW, SW and ESW;
- identification of sensitive receptors through desk study and consultations with the EA as reported within the FRA for the Proposed Development, and with TW as reported in the drainage strategy for this Proposed Development;
- identification of risks to water quality, water resources and flooding from Proposed Development and hence the likely magnitude of change and significance of environmental effects during both the demolition/construction and operational phases;
- development of mitigation strategies through consultation with the design team and stakeholders including potable and foul water treatment providers, LLFAs and the EA among others (see paragraph 17.7 for details of consultation);
- identification of opportunities for enhancement of surface water quality and surface water management through design and mitigation; and
- identification of residual effects and identification of cumulative effects.

Assessment of effects

Receptor sensitivity

17.19 A qualitative assessment of receptor sensitivity is described in Table 17.5.

Table 17.5: Criteria for determining receptor sensitivity.

Sensitivity	Criteria

High	Water body of high amenity value, including areas of bathing and water sports are regularly practiced. Water body of good or high chemical or ecological status. Includes designated bathing waters, shellfish and salmonid fisheries. A source used for public water supply or designated as a source protection zone. Site of Special Scientific Interest (SSSI), Special Protection Area (SPA)/Special Area of Conservation (SAC), Ramsar site or highly sensitive aquatic ecosystem. Water bodies currently failing water quality objectives. Areas which are highly vulnerable. With reference to flood risk. These can include essential infrastructure, emergency services and basement dwellings.
Moderate	Water body of moderate amenity value including public parks, boating, non-contact sports, popular footpaths adjacent to water courses, or watercourses running through housing developments/town centres. Water body of moderate ecological status and/ or non - public water supply or cyprinid fishery. Water body of nature conservation importance at the regional level or a moderately sensitive aquatic ecosystem e.g. Site of Nature Conservation Interest (SNCI). Areas which are more vulnerable. With reference to flood risk, these can include hospitals, residential units, educational facilities and waste management sites.
Low	Water body of poor ecological status. A source in close proximity to a source protection zone or abstraction point. Water body of particular local social/cultural/educational interest. Water body of low amenity value with only casual access, e.g. along a road or bridge in a rural area. Areas which are less vulnerable. With reference to flood risk, these can include retail, commercial and general industrial units, agricultural/forestry sites and water/sewage treatment plants.
Negligible	Low sensitivity aquatic ecosystem. Water of poor ecological status. Water body of no amenity value, seldom used for amenity purposes, in a remote or inaccessible area. Areas that are considered to be water compatible. With reference to flood risk, these can include flood control infrastructure, docks/marinas, pumping stations and recreational/landscape areas.

Magnitude of change/impact

17.20 The qualitative criteria used to assess how far an effect deviates from the baseline condition, i.e. the magnitude of change, are described in Table 17.6.

Table 17.6: Criteria for determining effect magnitude

Magnitude	Criteria

Large	Wholesale changes to the watercourse, alignment or hydrology. Significant changes to soil erosion or sedimentation patterns. Major changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in an increase in discharge/run-off with flood/sewerage exceedance potential. A large increase to flood risk of water bodies and areas downstream. A large risk of flooding to site infrastructure and users, as determined by an on-site FRA in accordance with NPPF.
Medium	Some fundamental changes to the watercourse and hydrology. Moderate changes to soil erosion or sedimentation patterns. Moderate changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in an increase in discharge/run-off within system capacity. A medium increase to flood risk of water bodies and areas downstream. A medium risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPPF.
Small	Minor changes to the watercourse. Minor changes to soil erosion or sedimentation patterns. Minor changes to the water chemistry of surface run-off and groundwater. Changes to site resulting in slight increase in discharge/run-off well within drainage system capacity. A small increase to flood risk of water bodies and areas downstream. A small risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPFF.
Negligible	No change to the watercourse, run-off and soil erosion and sedimentation patterns and water chemistry. Very minor to no change in discharge run-off and increased pressure on sewer capacity. No increased flood risk to water bodies and areas downstream. No risk of flooding to site infrastructure and users, as determined by an onsite FRA in accordance with NPPF.

Significance evaluation

17.21 The significance of a potential effect is derived by considering both the sensitivity of the feature and the magnitude of change, as demonstrated in Table 17.7.

Table 17.7: Matrix for determining effect significance

		Magnitude of change / impact			
		Large	**Medium**	**Small**	**Negligible**
Receptor value	**High**	Major	Major	Moderate/Minor	Negligible
	Moderate	Major	Moderate	Minor	Negligible
	Low	Moderate/Minor	Minor	Minor	Negligible

	Negligible	Negligible	Negligible	Negligible	Negligible

17.22 Note that moderate and major effects are considered to be 'significant', and minor and negligible effects are considered 'not significant'. Where the determination falls in the category of moderate/minor, the determination of whether it is moderate (significant) or minor (not significant) is based on the professional judgment of the assessor with justification provided in the assessment.

FRA methodology

17.23 Where the FRA is undertaken in relation to the formal River Thames flood defences, design crest levels have been set in accordance with the EA's Thames Estuary 2100 (TE2100) Plan (EA 2012) and associated guidance documents.

17.24 Proposed Development ground or building levels were incorporated in the hydraulic flood model to assess impact to the Site and offsite areas. An iterative approach was taken to determine the levels that will be required for building plots or flood mitigation measures.

17.25 Two flood models were created for the project: the Baseline 2020 model, and the Proposed 2020 model. These models were developed from hydraulic flood models provided by the EA to assess the tidal flood risk and impact from breach scenarios.

17.26 The Baseline 2020 model is primarily based on the EA North Kent Coast 2018 (NKC18) hydraulic model representing the Kent Project Site with the following updates:

- drone topographic survey of the Kent Project Site undertaken in July 2020;
- 2D coverage on the north side of the Thames in the location of the Essex Project Site boundary, consisting of the latest available LiDAR data for the area (Composite DTM 2019 1m resolution), as well as available OS mapping and known flood defence crest levels as received from the EA; and
- updated inflow boundaries using the latest available EA climate change guidance based on the Met Office's latest UK climate change projections (UKCP18).

17.27 To assess the Proposed Development, the Proposed 2020 model was based on the Baseline 2020 model with the addition of:

- ground and building levels of the Proposed Development; and
- flood risk mitigation measures.

17.28 For Fluvial analysis of the London Resort Kent Project Site (Access Road), the Ebbsfleet 2016 hydraulic model was used with the following updates:

- Updated inflow boundaries using the latest available EA climate change guidance based on UKCP18.

17.29 There is no confirmed decommission date for the Resort. However, considerations have been made for a 100-year development life (2125) and the flood risk impact and flood mitigation measures that may be required to keep the development safe in that timeframe.

Water quality survey methodology

17.30 Following consultation, the EA requested that water quality monitoring is undertaken for the Kent Project Site. This was due to the contaminated nature of the site and the presence of surface water bodies in and around the Kent Project Site, including marshland, rivers and channels that lie within the Site. Note that ground water depth and quality monitoring is also being undertaken and is reported in Chapter 18 Soils, Hydrogeology and Ground Conditions (document reference 6.1.18).

17.31 Surface water and ground water sampling will be undertaken in order to generate a robust baseline prior to construction, in order to ensure that the construction and operational activities do not cause deterioration of surface water bodies.

17.32 Water quality testing is proposed to be undertaken using manual sample collection and laboratory analysis. The monitoring locations and the analytical parameters have been agreed with the EA. Locations are shown in Figure 17.1.

17.33 A broad range of parameters will be tested for initially, and the testing suite refined over time. Surface water monitoring will be undertaken through water and sediment sampling. Surface water grab samples will be taken in accordance with the British Standard guidance on water quality sampling – BS EN ISO 5667-14:2016 – and transported to the analytical laboratory in cool boxes, with frozen ice packs, on the same day.

17.34 Grab or spot samples of sediment will be taken at each of the surface water sampling locations. Samples will be taken in accordance with BS10175 and BS ISO 18400 and transported to the analytical laboratory in cool boxes with frozen ice packs on the same day.

17.35 Water quality data will be collected for a 12-month period prior to construction to provide a good contextual information about water quality and an updated baseline prior to on-site works.

Hydrodynamic Modelling

17.36 The purpose of the hydrodynamic and sedimentation assessment is to understand the local tidal flow regime within the Thames and assess the impacts of the proposed marine development options. HR Wallingford undertook the assessment, for further details please refer to Appendix 17.4 (document reference 6.2.17.4). The flow environment was

obtained based on the Thames Base model, a numerical flow model of the whole Thames Estuary set up by HR Wallingford in partnership with the EA and the PLA to assist the two organisations with their regulatory responsibilities.

17.37 The modelling suite used for the Thames Base model is TELEMAC, originated by EDF-LNHE. The location of the Kent Project Site is between sharp bends in the river at Broadness and Stoneness, suggesting 3D flows will be important.

Surveys relevant to water resources and flood risk

Table 17.8: Surveys relevant to water resources and flood risk

Survey and Date	Details
CCTV drainage survey (September 2020)	Undertaken to examine condition of current drainage systems and the source of offsite flows into the system in the Kent Project Site.
Water quality survey (Ongoing – starting October 2020)	Comprises monitoring of water quality in the surface water bodies across the Kent Project Site as well as ground water. The monitoring will inform the baseline conditions as well as monitoring before, during and post-construction.

Assessment limitations (technical deficiencies or lack of knowledge)

17.38 The water environment is sufficiently understood for the purpose of this assessment.

17.39 Initial results from the water quality testing programme have been received and these are presented in Appendix 17.3 (document reference 6.2.17.3). However, a year's worth of data will be collected before construction works commence, and the results available at the time of writing only present a small sample of the water quality conditions. A more robust baseline will be developed over the course of the sampling programme.

17.40 The water supply strategy for the Proposed Development has not been fully developed and discussions are still ongoing with Thames Water to discuss how its needs are met.

17.41 A WWTW to manage foul water is proposed for the Kent Project Site. While the conditions and parameters of its operation will be agreed with the EA and defined within its operational permit, these are unknown at this stage.

17.42 The understanding with regard to flood risk, foul water drainage and surface water drainage has been informed through a number of best practice modelling techniques. This has produced the best, accurately available, baseline and future scenario models.

RELEVANT LAW, POLICY AND GUIDANCE

17.43 The legislation, policy and guidance that has influenced the assessment is listed below.

Law

- Water Resources Act 1991;
- Water Resource Act 1991 (Amendment) (England and Wales) Regulations 2009;
- Water Act 2003;
- Water Act 2014;
- Environment Act 1995;
- Environmental Protection Act 1990;
- Flood and Water Management Act 2010;
- The Flood Risk Regulations 2009;
- Anti-Pollution Works Regulations 1999;
- Water Supply (Water Quality) Regulations 2018;
- Control of Pollution (Oil Storage) (England) Regulations 2001;
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- Environmental Damage (Prevention and Remediation) Regulations 2015;
- The Environmental Permitting (England and Wales) Regulations 2016;
- Town and Country Planning (Development Management Procedure) (England) Order 2015

National policy and guidance

National Planning Policy Framework (NPPF) (MHCLG, 2019)

17.44 The NPPF sets out the Government's planning policies for England and how they are expected to be applied. In terms of Water Resources and Flood Risk, the NPPF sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow, with a view to achieving sustainable development.

17.45 Footnote 50 to the NPPF states that a site-specific FRA is required for proposals of 1

hectare or greater in Flood Zone 1; and all proposals for new development in Flood Zones 2 and 3, or in an area within Flood Zone 1, which has critical drainage problems (as notified to the local planning authority by the EA); land identified in a strategic flood risk assessment as being at increased flood risk in future; and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

17.46 The principles of policy relevant to water resources and flood risk are provided in Section 14 'Meeting the challenge of climate change, flooding and coastal change' and Section 15 'Conserving and enhancing the natural environment'.

17.47 With reference to new development, Paragraph 149 of the NPPF states:

'*Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure...When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure'.*

17.48 In addition, Paragraph 155 of the NPPF states:

'*Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.*'

17.49 The NPPF further states that those proposing development are responsible for drainage designs which reduce flood risk to the development and elsewhere, preferably through the use of sustainable drainage systems (SuDS).

National Planning Practice Guidance (updated 2015)

17.50 To accompany the NPPF, the web-based National Planning Practice Guidance (PPG) provides additional technical guidance on flood risk and coastal change.

17.51 In terms of the general planning approach to development and flood risk, the Flood Risk and Coastal Change PPG sets out the following main steps to be followed:

- Assess flood risk;
- Avoid flood risk; and
- Manage and mitigate flood risk.

17.52 The guidelines also state that in plan-making, local planning authorities apply a sequential approach to site selection so that development is, as far as reasonably possible, located where the risk of flooding (from all sources) is lowest, taking account of climate change and the vulnerability of future uses to flood risk. In plan-making this involves applying the 'Sequential Test' to Local Plans and, if needed, the 'Exception Test' to Local Plans. Guidance on when and how should the 'Sequential' and 'Exception' Tests be applied to planning applications is also provided in the PPG.

17.53 In addition, the guidelines reiterate that local planning authorities and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems in developments).

17.54 Additionally, the guidelines note that when considering a major development, as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015, SuDS should be provided unless demonstrated to be inappropriate.

17.55 Table 1 within section 25 Flood and Flood Risk Tables, defines the Flood Zones and the respective level of flood risk. Zone 1 depicts an area of low (<1 in 1000 year) probability. In contrast, zone 3b represents a functional floodplain, where water has to flow or be stored in times of flooding.

17.56 The PPG also contains a section on water supply, wastewater and water quality. This guidance indicates that water supply is unlikely to be a consideration for most planning applications as water supply is normally addressed through the Local Plan. With regard to water quality, the guidance states that it is only likely to be a significant planning concern when a proposal would:

- Involve physical modifications to a water body such as flood storage areas, channel diversions and dredging, removing natural barriers, construction of new locks, new culverts, major bridges, new barrages/dams, new weirs (including for hydropower) and removal of existing weirs; and/or

- Indirectly affect water bodies, for example:
    - As a result of new development such as the redevelopment of land that may be affected by contamination, mineral workings, water or wastewater treatment, waste management facilities and transport schemes including culverts and bridges; and

    - Through a lack of adequate infrastructure to deal with wastewater.

National Policy Statements

17.57 National Policy Statements (NPS) set out the need for and government's policies to deliver Nationally Significant Infrastructure Projects (NSIPs) in England. Chapter five of this ES

explains that there is no NPS for business and commercial NSIP projects. However, to the extent that the Proposed Development includes transport and highways infrastructure regard will be had to relevant policy in the NPS for National Networks (NPS NN), including:

- Environmental and Social Impacts (NPS NN paragraphs 3.2 to 3.5).
- Climate Change Adaptation (NPS NN paragraphs 4.36 to 4.47).
- Pollution Control and other Environmental Protection Regimes (NPS NN paragraphs 4.48 to 4.56).
- Flood Risk (NPS NN paragraphs 5.90 to 5.115).
- Water Quality and Resources (NPS NN paragraphs 5.219 to 5.231).

17.58 To the extent that the Proposed Development includes marine works related to the Port of Tilbury, regard will be paid to relevant policy in the NPS for Ports (NPSP)

- Pollution Control and other Environmental Regimes (NPSP paragraphs 4.11.1 to 4.11.18).
- Climate Change Mitigation (NPSP paragraphs 4.12.1 to 4.12.10).
- Climate Change Adaptation (NPSP paragraphs 4.13.1 to 4.13.15).
- Flood Risk (NPSP paragraphs 5.2.1 to 5.2.28).
- Water Quality and Resources (NPSP paragraphs 5.6.1 to 5.6.12).

Other national policy and guidance

- National Planning Practice Guidance – Water Supply, Wastewater and Water Quality (MHCLG, 2019);
- National Infrastructure Planning Advice Note 18: Water Framework Directive (Planning Inspectorate, 2017);
- National Flood & Coastal Erosion Risk Management Strategy for England (2020)
- National Planning Practice Guidance – Flood Risk and Coastal Change (MHCLG, 2014);
- National Planning Practice Guidance – Flood Risk Assessments: Climate Change

Allowances (EA, Published 19 February 2016, Last updated 22 July 2020);

- Future Water (2008);
- Making Space for Water (2015);
- Water for Life (white paper) (2011); and
- CIRIA SuDS Manual C753, (2015).

Local policy

South Essex Catchment Flood Management Plan (2009)

17.59 The South Essex Catchment Flood Management Plan (CFMP) is one of 77 CFMPs for England and Wales. It assesses inland flood risk and establishes flood risk management policies which seek to deliver sustainable flood risk management for the long term. The Essex Project Site is within the Thames Urban Tidal catchment of the South Essex CFMP, with Policy option 4 most applicable to this region, which sets out the following key recommendations for this area:

- *Storing water on the floodplain upstream can reduce flood risk to the settlements in this sub-area;*
- *Investigate improving current maintenance activities to manage flood risk into the future;*
- *Emergency response and flood awareness plans will be used to manage flood risk from the flood defences failing or being overwhelmed;*
- *Organisations to take an integrated approach to managing river, tidal and surface water flooding.*

17.60 The proposed actions to implement the preferred policy are:

- *Investigate improving current maintenance activities to manage the flood risk into the future;*
- *Reduce the consequences of flooding by improving public awareness of flooding and encouraging people to sign up to, and respond to, flood warnings. Flood awareness plans will inform people about the risk of defences breaching and the actions they can take to protect themselves and their property;*
- *Develop emergency response plans to manage flood risk from the defences failing or being overwhelmed, and work with partners to manage flood risk to critical*

infrastructure;

- *Develop a flood storage study to investigate the feasibility of creating storage areas, natural or engineered, along the river corridor upstream of this sub-area to manage future flood risk;*

- *Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be resilient to flooding and provide opportunities to improve river environments;*

- *Work with partners to develop a Surface Water Management Plan for Canvey Island, Tilbury and Purfleet.*

Kent County Council

Kent County Council Drainage and Planning Policy (2019)

17.61 Kent County Council Drainage and Planning Policy – a Local Flood Risk Management Strategy Document sets out how Kent County Council (KCC), as Lead Local Flood Authority (LLFA) and statutory consultee, will review drainage strategies and surface water management provisions associated with applications for major development. It is consistent with the Non-Statutory Technical Standards for Sustainable Drainage (as published by Defra in March 2015) and sets out the policy requirements KCC has for sustainable drainage.

Dartford Borough Council

Dartford Development Policies Plan (2017)

17.62 The Dartford Development Policies Plan (July 2017) sets out the main planning policies that the authority will use to assess planning applications. Policy DP11: Sustainable Technology and Construction states:

'*Development should be well located, innovatively and sensitively designed and constructed, to tackle climate change, minimise flood risk and natural resource use and must aim to increase water efficiency. Reflecting water scarcity and development levels in the region, and to deliver the aims of Core Strategy policy CS25, all dwellings (Class C3) created in Dartford will be permitted only where they demonstrate delivery of the water efficiency requirement level of 110 litres per person per day*.'

Dartford Borough Council Core Strategy (2011)

17.63 This document sets out Dartford Borough Council's (DBC) long-term spatial strategy for

the Borough to 2026 and acts as an implementation tool for those elements of the Sustainable Community Strategy that can be delivered through spatial planning.

17.64 Policy CS6: Thames Waterfront states:

'*The Council will promote the creation of a vibrant mixed-use riverfront, incorporating sustainable communities, new employment opportunities, leisure use of the river /riverside and use of the river for sustainable transport, by… Require that Planning applications for development in Flood Zones 2 and 3 are accompanied by a site-specific FRA to demonstrate that development is safe and will pass Part C of the Exception Test, where applicable. These sites to also be sequentially tested to direct 'more vulnerable' uses to the parts of the site at less risk of flooding, where possible…'*

17.65 Policy CS 24: Flood Risk states:

'To manage and mitigate flood risk the Council will:

a) Ensure that sites in Flood Zone 2 and 3a, shown to be acceptable for development following application of the Sequential Test and parts A and B of the Exception Test, demonstrate that part C of the Exception Test can be passed and that residual risk is managed through a Flood Risk Assessment (FRA) and an appropriate Flood Plan. Windfall sites will be subject to the same tests to assess whether they are appropriate for the development proposed.

b) Engage with the Environment Agency and Defra in the further stages of the Thames Estuary 2100 Project (TE 2100), and seek not to foreclose any medium or long-term options through proposals in this Plan. In particular, the Council will protect the Dartford Marshes from development, in the event that the area is required to implement flood protection proposals or compensation freshwater habitats.

c) Require the SUDS 'management train' to be applied, as appropriate, in all new development. In Water Source Protection Zones, SUDS will need to demonstrate that any surface water run-off infiltrating the ground will not lead to deterioration of groundwater quality.

d) Identify and implement a green infrastructure network through the safeguarding of existing areas of open space and a requirement for generous provision of green space and water bodies in new development (see Policy CS 14).

17.66 Policy CS 25: Water Management states:

'To manage the supply and quality of water and waste water / sewerage treatment capacity serving the community, to protect and enhance the quality of surface and ground waters together with assisting in moving towards 'water neutrality' in the Thames Gateway, the Council will:

a) Work with the water utility providers and monitor development to ensure that new development and water services are co-ordinated and that the pace of development does not outstrip the water supply and waste water/ sewerage treatment capacity at any time. Where development is not capable of being adequately supplied, the Council will review the phasing of development and work with the utility providers and developers to address the capacity constraints at the earliest opportunity.

b) Require all new homes to achieve at least level 4 of the Code for Sustainable Homes in terms of water use (105 litres per person per day) in advance of mandatory requirements. Where it can be demonstrated that a development is unable to meet these standards, permission will only be granted if the applicant makes provision for compensatory water savings elsewhere in the Borough.

c) Sites of 500 units or more will be expected to act as exemplars. In addition to b above, they will be required to reduce dependence on potable water through rainwater harvesting, recycling of used water and reduction of water 'hungry' activity, and should be designed to enable later retrofitting to achieve the highest levels of the Code for Sustainable Homes in terms of water use.

d) Require all non-residential developments of 1,000sqm and above to meet the BREEAM 'excellent' standards of water efficiency.

e) Work with and encourage water utility providers and social landlords to fit existing homes and other buildings with more efficient devices and appliances; reduce leakage; and expand metering.'

Gravesham Borough Council

Gravesham Borough Council Local Plan (2014)

17.67 The Local Plan, and in particular the Core Strategies document that sits within that, sets out policies that aim to shape the future of the Borough and help determine individual planning applications.

17.68 Of direct relevance to the Proposed Development is Policy CS03: Northfleet Embankment and Swanscombe Peninsula East opportunity Area which sets out particular strategies and aims for development within this area. Sub-area 1.1 Swanscombe Peninsula East Undeveloped Area includes part of the Kent Project Site. The document states that any development should come forward using a comprehensive masterplan approach that has regard to proposals for the Dartford part of the peninsula, development phasing and the possible need for a new highway link to relieve the existing A226 and improve accessibility to the peninsula.

17.69 The policy wording at 4.4.29 states:

"*Any future proposals for the Swanscombe Peninsula East Undeveloped Area will be subject to a comprehensive masterplan approach which deals with the issues of flood risk, transport and access, ground conditions, proximity to existing industrial uses, air quality, biodiversity, utilities, navigation and the presence of the HS1 railway line*."

17.70 A partial review of the Local Plan Core Strategy is currently ongoing, with a Stage 2 consultation underway, running from 23 October 2020 until 31 December. This follows on from the Stage 1 consultation, which closed on 11 July 2018. Once adopted, these documents will form part of the Development Plan and replace some of the policies in the adopted Local Plan Core Strategy and the remaining saved policies in the Gravesham Local Plan First Review. The review focuses on the Site Allocations and Development Management Policies

Thurrock Council

Thurrock Council Local Plan (1997)

17.71 The Council are in the process of developing a new Local Plan for Thurrock, however this is in the early stages of development and is not anticipated to be adopted until 2021.

17.72 The Thurrock Local Plan (1997) has no Saved Policies that specifically relate to flood risk management. However, the following policy is considered relevant:

17.73 Policy BE 28: The Prevention of Water Pollution states:
'*Development proposals which the Council considers would be likely to lead to undesirable and unnecessary pollution will not be permitted*.'

Thurrock Local Flood Risk Management Strategy (2015)

17.74 The Thurrock Local Flood Risk Management Strategy sets out the following objectives for managing flood risk. These contribute to achieving the priorities set out in the Corporate Plan and are consistent with the objectives and principles of the National Strategy.

- *Objective 1 (L1) Reduce the likelihood and consequences of flooding, particularly from surface water, groundwater and ordinary watercourses;*
- *Objective 2 (L2) Identify any gaps where further studies are required so we can get a better understanding of the causes and effects of local flooding;*
- *Objective 3 (L3) Reduce the vulnerability of Thurrock, its residents and visitors to the detrimental effects of flooding;*
- *Objective 4 (L4) Establish clear roles, powers and responsibilities for Thurrock RMAs and ensure RMAs are aware of each other's roles and responsibilities;*

- *Objective 5 (L5) i) Provide improved communication of clear information on local flood risk, appropriate responses and the responsibilities for us and our partners; and ii) State what we and other RMAs cannot take responsibility for, and facilitate engagement of the public and stakeholders to take action;*

- *Objective 6 (L6) Improve co-operative working between all RMAs, including across administrative boundaries;*

- *Objective 7 (L7) Improve natural habitat and the social environment through flood management schemes to provide multiple benefits; and*

- *Objective 8 (L8) Establish a strategic funding plan and programme so we identify priorities, secure funding for measures that are affordable and that wherever possible include provisions for contributions by those who benefit.*

Thurrock Council Core Strategy and Policies for the Management of Development (2011, updated 2018)

17.75 The Core Strategy and Policies for Management of Development sets out the Council's vision for development in the Borough and policies against which planning application for the development and use of land and buildings will be considered.

17.76 Strategic Spatial Objective 18 sets out the Council's aim 'to reduce and manage the risk of flooding to and from development through its location, layout and design'. The Strategic Spatial Objective is supported by Core Strategic Thematic Policy (CSTP) 27 and Development Management Policy 15.

17.77 CSTP25 Addressing Climate Change: Paragraph 5.157 states that the Thurrock Climate Change Evidence Base seeks to:

- *Ensure that new development incorporates energy and water efficiency into design;*

- *Ensure new build development incorporate climate change 'resistant' features to minimise vulnerability;*

- *Ensure that new vulnerable development is not at risk of flooding; and*

- *Reduce flood risk at existing development.*

17.78 CSTP27 Management and Reduction of Flood Risk states:

- *The Council will ensure that, where necessary, new development throughout the Borough contains space for water including naturalisation and environmental enhancement;*

- *Developers will be required to contribute towards flood risk management infrastructure where appropriate;*

- *Planning applications received for sites within Flood Zone 3 will be treated in accordance with Planning Policy Statement (PPS) 25, this policy and Policy for Management of Development (PMD) 15.*

17.79 CSTP27 emphasises the importance of guidelines contained within the Thames Estuary 2100 (TE2100) study and points to TE2100 'recommended actions' (A5.3 – A5.9) for achieving the desired level of flood protection. It places responsibility for the desired outcome on all stakeholders including developers.

17.80 The policy recognises that for the West Thurrock area, drainage infrastructure will require upgrading as sea level rises and rainfall intensity increases over the next 100 years. Mitigation measures are expected to include improved outfalls and drainage channels, additional pumping capacity, additional flood storage and new or improved local flood defences.

17.81 CSTP28 River Thames: sub-clause III states that development proposals will be required to undertake appropriate level of flood risk assessment as set out by PPS25 and take account of the need for flood mitigation measures and to accommodate any necessary flood defence measures.

17.82 Policy PMD2 Design & Layout: sub-clause 1.viii (Landscape) indicates that all new development will be required to contribute to multiple uses and/or eco-system services, including amenity, recreation, flood alleviation and sustainable urban drainage systems (SuDS).

17.83 PMD15 Flood Risk Assessment reiterates the requirements of policy CSTP28 regarding flood risk from the Thames River. This includes the following points:

- *Sites not covered by the Thurrock Sequential Test will be required to provide a site-specific Sequential Test to demonstrate compliance with NPPF or any successor to be provided by the applicant. To reflect the nature of Thurrock's defended floodplain, particular reference should be made to the hazard rating for each site where covered by the Thurrock Strategic Flood Risk Assessment;*

- *Only those applications classified under the 'minor development' or 'changes of use' categories will be exempt from applying the Sequential Test, but will still be expected to meet the requirements for Flood Risk Assessments and flood risk reduction as set out in NPPF and the associated Design and Sustainability SPD;*

- *Development proposals subject to the Exception Test in Thurrock must show that the following criteria have been met (in addition to FRA requirements outlined in NPPF):*

- *To assist with part a) of the Exception Test, reference should be made to the main assessment criteria outlined in the Thurrock Sustainability Appraisal and any opportunities to reduce the overall flood risk posed to the community, including schemes to make space for water;*

- *The FRA must demonstrate that the development will be 'safe', without increasing flood risk elsewhere, and where possible will reduce flood risk overall.*

- *Developers may be required to provide developer contributions towards the improvement of emergency planning services and flood defence measures within Thurrock as part of flood management mitigation;*

- *Developments will be expected to incorporate Sustainable Drainage Systems (SuDS) to reduce the risk of surface water flooding, both to the site in question and to the surrounding area. Where the potential for surface water flooding has been identified, site specific Flood Risk Assessments should ensure that suitable SuDS techniques are incorporated as part of the development.*

Thurrock Strategic Flood Risk Assessment: Level 1 (2018)

17.84 The chief purpose of the Thurrock Strategy Flood Risk Assessment (SFRA) is to provide strategic overview of flood risk within the borough to enable effective risk-based strategic planning for the future through the preparation of the Local Plan.

17.85 The document confirms that the primary flood risk to the borough is from tidal overtopping of flood defences and breach.

17.86 The document confirms that the Thames formal flood defences provide a standard of protection to the borough up to a present day 0.1% annual exceedance probability storm event, however climate change will require improvements to the flood defence crests in order to maintain this standard of protection in the future.

17.87 The document identifies a secondary source of flood risk to the borough as being surface water and fluvial flooding from the Tilbury drainage channels.

17.88 The channels in the Tilbury area are reliant on pumping stations to drain the marshlands which are in places below sea level. There are two significant unnamed drainage channels in the proximity of the Essex Project Site.

Other relevant guidance

Pollution Prevention Guidance Notes (now withdrawn)

17.89 The former EA Pollution Prevention Guidance (PPG) notes provide advice on statutory

responsibilities and good environmental practice. Whilst this guidance was withdrawn and as of December 2015 will no longer be updated by the EA, it is still considered good practice. A review plan for the PPGs is currently underway and a replacement guidance series, Guidance for Pollution Prevention (GPP) is being introduced. The following relate to either the withdrawn, but as yet not replaced, PPGs, or the replacement GPPs. The guidance notes of particular relevance to the Proposed Development include:

- GPP1 (October 2020): Understanding your environmental responsibilities – good environmental practices. A basic introduction to pollution prevention, with signposts to other GPPs and publications;

- GPP2 (January 2018): Above ground oil storage tanks – provides guidance to those responsible for the storage of oil on construction sites. The document provides guidance on location, bunding, protection and operation of oil stored in addition to maintenance and brief guidance on dealing with spills;

- PPG3 (April 2006): Use and design of oil separators in surface water drainage systems – provides guidance on when oil separators are appropriate and what size and type of separators is required;

- GPP4 (November 2017): Treatment and disposal of wastewater where there is no connection to the public foul sewer – for selecting the correct sewage disposal, treatment and disposal options, and maintenance and legal requirements. Also, for what to have in mind, in terms of wastewater treatment, when buying a house;

- GPP5 (February 2018): Works and maintenance in or near water – for construction or maintenance works near, in, or over water;

- PPG6 (2012): Working at construction or demolition sites – mirrors much of PPG5 but with particular emphasis on the situations likely to occur at demolition and construction sites;

- PPG7 (July 2011): Refuelling activities – provides information on the correct delivery, storage and dispensing of fuel to help reduce the risk of pollution; and

- GPP21: Pollution incident response planning – provides guidance to those developing site-specific pollution incident response plans to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

Construction Industry Research and Information Association Guidance

17.90 The Construction Industry Research and Information Association (CIRIA) carries out research activities and provides guidance for developers and contractors. The guidance with specific relevance to water resources and flood risk are:

- Guidance C532 – Control of Water Pollution from Construction Sites. This brings together the Environment Agency guidance but goes into much more detail with regard to sources of water on construction sites, pollutants and pathways, in addition to providing guidance on planning for the type and location of suitable control measures; and

- Guidance C753 – The SuDS Manual. This provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their best effective implementation within developments.

BASELINE CONDITIONS

Current baseline

Existing land use

17.91 Chapter two of this ES provides a full description of the current Project Site use. A summary is provided below for the aspects relevant to the water related assessment of the Project Site.

Kent Project Site

17.92 For the Kent Project Site, land-use is principally open, low-lying land with former cement kiln dust (CKD) tips and other brownfield former industrial land. The Peninsula part of the Project Site is both a 'historic' and 'authorised' landfill site. The main product of this landfill waste is CKD. Land disposal of CKD creates highly alkaline conditions. This can lead to absorption of metals including barium, beryllium, cadmium, chromium and lead in groundwater. Accordingly, mobilisation of contaminants will need to be avoided.

17.93 A number of drains, filtration systems, aeration lagoons and other features are also present. Much of the Peninsula has re-vegetated naturally but areas of bare ground remain. Other parts of the Kent Project Site on the Swanscombe Peninsula include the existing Manor Way, Northfleet, Kent Kraft and Rod End industrial estates.

17.94 The HS1 railway crosses the Peninsula on a south-east to north-westerly alignment. The southern section is in cutting and the remainder in a tunnel.

17.95 In 2021, the Swanscombe Peninsula was classified as a Site of Special Scientific Interest (SSSI). This is designated as such due to it being an area of open mosaic habitat on previously developed land which provides nationally important assemblages of invertebrates and breeding birds, specific populations of vascular plants as well as

geological features.

~~17.95~~17.96 The ~~Swanscombe Peninsula~~peninsula supports extensive areas of marshland including Black Duck Marsh, Botany Marsh and a marsh around the HS1 tunnel portal. Broadness Marsh at the northern tip of the Peninsula was historically a saltmarsh, but now has a raised terrain as a result of CKD tipping and the deposition of dredged river material. Broadness and Botany Marshes are bordered, in part, by industrial uses.

~~17.96~~17.97 The Swanscombe Peninsula contains some existing marine infrastructure in Bell Wharf and White's Jetty. These are located on the western side of the peninsula and were the terminus of a mineral railway associated with the cement works that operated on the peninsula. More detail on the existing marine infrastructure can be found in the Marine Infrastructure sections of this chapter.

~~17.97~~17.98 The Kent Project Site extends south to the A2(T) road. The A2(T) / A2260 junction (referred to here as Ebbsfleet Junction) allows eastbound and westbound traffic to leave and join the A2(T) at the southern end of the Kent Project Site.

~~17.98~~17.99 East of the Kent Project Site, adjacent to Thames Way (A226) is Sawyer's Lake, a lake of approximately 11.5 ha which is used for recreation. The linear Castle Hill Lake, approximately 5.8 ha in area situated north of the A2(T) adjacent to the access road part of the Kent Project Site is also used for recreation.

Essex Project Site

~~17.99~~17.100 The north of the Essex Project Site comprises level hard-surfaced land used currently for vehicle storage. The Essex Project Site is bounded by railways on its northern and western sides, and a drainage channel to the east.

~~17.100~~17.101 The Essex Project Site also includes the Tilbury Ferry Terminal and the Tilbury Landing Stage that projects into the River Thames.

~~17.101~~17.102 Tilbury Docks lies approximately 400 m to the west of the Essex Project Site boundary. Approximately 250 m east of the boundary is situated Tilbury Fort, which has a surrounding water-filled moat.

Existing site levels

Kent Project Site

~~17.102~~17.103 The Peninsula has a variable topography because of historical CKD tipping activities and the deposition of dredgings from the River Thames. Two raised areas of tipped material rise to over 12-13 m above ordnance datum (AOD). A large part of the north of the Peninsula has been raised from an assumed original height of 2-3 m AOD to approximately 8.75 m AOD. Where it meets the River Thames, the Peninsula is surrounded by flood defence embankments and terraces that rise to approximately six metres AOD.

Small areas of remnant salt marsh are located at the base of the flood defences.

~~17.103~~17.104 Figure 17.2 shows spot elevations of the topography at the Kent Project Site.

Essex Project Site

~~17.104~~17.105 The Essex Project Site is generally flat with elevations of Made Ground ranging from 1-3 m AOD.

Groundwater

Kent Project Site

~~17.105~~17.106 Issues associated with ground contamination, mobilisation of ground contaminants and hydrogeology are covered in Chapter 18 Soils, hydrogeology and ground conditions (document reference 6.1.18). A summary of ground conditions and groundwater is provided here for context.

~~17.106~~17.107 The general topography is variable across the Kent Project Site, with low-lying, undulating land towards the north due to natural marshland and historical landfilling. Substantial chalk spines are present in the centre of the Kent Project Site, upon which roads and railway lines run, approximately 16-20 m above the surrounding ground.

~~17.107~~17.108 Made Ground varies across the Peninsula, with predominantly cement kiln dust (CKD) towards the north, while towards the south it comprises compressed chalk, clay, sand and gravels that have been used to backfill pits and quarries, together with a mixture of domestic and commercial wastes within landfilled areas.

~~17.108~~17.109 Alluvium covers a large portion of the Swanscombe Peninsula north of Manor Way, and these deposits are predominantly silty clay and clayey silt, with some coarser grained units. Historical borehole records indicate two prominent layers of peat across the Peninsula, at approximately -4 m and -8 m AOD. Head deposits are anticipated across small pockets of the Peninsula, formed from the Chalk bedrock. Both the Alluvium and the Head deposits beneath the Peninsula are classified as Secondary 'A' aquifers by the EA, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale.

~~17.109~~17.110 The BGS Hydrogeological Maps suggest that regional groundwater flow in the area is north, towards the River Thames, although abstractions associated with the number of quarries in the vicinity of the development will have an impact on flow direction locally.

Essex Project Site

~~17.110~~17.111 The anticipated geology is a heterogeneous composition of Made Ground (including ash, concrete, brick, timber, flint), typically between about 1 and 3m, underlain by a natural geological sequence comprising about 15m of Alluvium (very soft to firm clays,

peats and sands) over a relatively limited thickness (approximately 2 to 5m) of River Terrace Gravels. Beneath these is the Upper Chalk at about 18 to 24m bgl.

~~17.111~~17.112 Part of the Essex Project Site extends onto the shore of the River Thames. This area is underlain by tidal deposits. BGS borehole records indicate this to include about 12 to 20m of alluvial clays and peats, over River Terrace Gravels, with Chalk present at about 22 to 23m bgl.

~~17.112~~17.113 Perched groundwater is likely to be present above low permeability bands in both the Made Ground and the Alluvium. EA Aquifer maps show the Essex Project Site to be underlain by a Secondary (Undifferentiated) Aquifer in superficial Alluvium and River Terrace Gravel deposits. The Upper Chalk bedrock is classified as a Principal Aquifer (defined as rock with high intergranular and / or fracture permeability). This stratum may support water supply and / or river base flow – although it is unlikely to be utilised for potable water supply in the vicinity due to its proximity to the River Thames. Groundwater levels across the Essex Project Site will be influenced by its proximity to the River Thames and associated tidal flows.

~~17.113~~17.114 There are limited records of groundwater strikes on BGS borehole records. However, where recorded / encountered shallow groundwater ingress was generally at approximately 1 to 2m bgl in Made Ground or Alluvium. A deeper groundwater body was recorded at the top of River Terrace Deposits at approximately 16 to 17m bgl, rising to between 8 and 9m bgl, indicating sub-artesian pressures due to confinement by the overlying Alluvium. This deeper body is likely to be in continuity with the Chalk.

Surface water features

~~17.114~~17.115 Surface water features exist within and in close proximity to the Project Site boundary. The nearest surface water features are:

Kent Project Site

- River Thames – borders the Kent Project Site to the north;
- River Ebbsfleet – an EA Main River located to the south east of the Peninsula running through part of the Kent Project Site from north of the A2(T) past Northfleet Station and into the River Thames;
- An EA-defined ordinary watercourse, that ~~is, it is not mained~~is not named, hereafter referred to as Swanscombe Channel, running south to north through the centre of the Peninsula, and therefore through the Swanscombe Peninsula SSSI, -and discharging to River Thames via a gravity culvert, and a HS1 culvert with pumping, north of the Jetty area;
- Black Duck Marsh including pond areas – within Swanscombe Peninsula SSSI and

drains into River Thames via unidentified outfalls;

- Botany Marsh including pond areas – within Swanscombe Peninsula SSSI and drains into the Swanscombe channel via a series of manmade channels;
- Central Pond – 0.7 ha small lake midway up the Swanscombe Peninsula (and within the SSSI), slightly to its western side.
- Ponds by HS1 –area containing some ponds to the east of the HS1 terminal.
- Sawyer's Lake – 11.5 ha lake adjacent to the eastern boundary of the Kent Project Site (adjacent to eastern edge of Thames Way (A226));
- Bamber Pit outfall pond – 0.5 ha flooded pit in south-eastern corner of Bamber Pit former landfill site and within the Swanscombe Peninsula SSSI;
- Castle Hill Lake – 5.8 ha linear lake located approximately 200 m north of the Kent Project Site access road (A2(T)); and
- Eastern Quarry – lake inside Ebbsfleet Garden City development site, approximately 400 m north of the A296 within the Kent Project Site access corridor.

~~17.115~~17.116 These features can be seen in Figure 17.4.

~~17.116~~17.117 It is proposed that Eastern Quarry Lake is not included in the assessment as this lies within a separate development masterplan, Ebbsfleet Garden City, which is currently under development, and is not proposed to remain in its current form as a result of that masterplan. Eastern Quarry Lake is currently being dewatered with the water pumped into the Kent Project Site, where it discharges through the Swanscombe Channel to the River Thames. Therefore, water from the lake is considered within this assessment where it forms part of the Swanscombe Channel water body. Ebbsfleet Garden City is included as a scheme in the cumulative impact assessment. Dewatering of the Eastern Quarry Lake, which currently discharges in to the Swanscombe Channel within the Kent Project Site will be redirected to discharge directly into the River Thames. More information on this is presented below in the 'Drainage' section.

~~17.117~~17.118 Bamber Pit Outfall Pond, which lies within the former Bamber Pit Landfill~~,~~ site will be removed to make space for the access road that will run adjacent to the train tracks at this location. The pond will be replaced with a similar sized pond slightly to the west of its current location. Therefore, Bamber Pit Outfall Pond is not assessed in construction and operational terms as it will not exist in its current state.

~~17.118~~17.119 The Central Pond on the Swanscombe Peninsula and the ponds by HS1 are both minor water receptors that will be removed as part of the Proposed Development. They are not considered to have significant amenity value from a water resource and water quality perspective and due to their proposed removal are not assessed in construction or

operational impact terms in this assessment. Equivalent wetland areas will be created to replace removed water features and provide an enhanced habitat. Further information on their removal and creation of the enhanced wetland areas is provided in the Relevant Aspects of the Scheme part within the Operational Impacts assessment.

~~17.119~~17.120 There are no significant hydrological links between the majority of the Kent Project Site and both Castle Hill Lake and Sawyer's Lake, and those areas that are closest to these water bodies are subject to negligible or minor construction processes. Sawyer's Lake is separated from the majority of the Site by the River Ebbsfleet which acts as a barrier between the Site and the lake. Therefore, surface water links to these receptors have not been considered further in this assessment, however they remain receptors for airborne pollution (e.g. dust and debris).

Essex Project Site

- River Thames – bordering and partly within the Essex Project Site to the south;
- East Tilbury Dock Sewer – Main River (as defined by EA) running north to south within the western part of the Essex Project Site boundary. It runs along the western side of the Site as an open channel up until a sluice approximately 350 m from the River Thames where it is culverted to its outfall into the Thames.
- Pincocks Trough sewerage channel – Main River (as defined by EA) running north to south 20 m east of northern area of Essex Project Site and discharging into the River Thames to the south;
- Tilbury Docks – approximately 400 m west of the Essex Project Site boundary; and
- Tilbury Fort moat – water-filled moat approximately 250 m east of the Essex Project Site boundary.

~~17.120~~17.121 These features can be seen in Figure 17.5.

~~17.121~~17.122 It is proposed that neither Tilbury Docks nor Tilbury Fort moat waters are included as receptors in the water resources assessment as there is no hydrological link between surface water on the Essex Project Site and these surface water bodies are sufficiently remote that impacts from air borne dust and debris will be negligible.

~~17.122~~17.123 The Essex Project Site also includes within its planning boundary the Asda Roundabout on the A1089, approximately 1.6 km north-west of the larger Essex Project Site plot. The proposals for this area comprise minor changes to the road system, which is not considered to have any significant impact on water resources or surface water features.

Statutory designations

17.124 Details on areas and protections associated with statutory designations are provided in Chapter 13 Marine ecology and biodiversity (document reference 6.1.13). Water quality is fundamental to the health of marine habitats, therefore an overview of statutory designations and the basis for designation is provided in this section.

17.125 Swanscombe Peninsula SSSI covers an area of 264.1 hectares across the majority of Swanscombe Peninsula as well as areas extending to the south along the western side of the HS1 Railway line. It is of special interest for its nationally important assemblages of invertebrates and breeding birds as well as vascular plant species and geological features.

~~17.123~~ The SSSI includes Black Duck Marsh and Botany Marsh which are located on either side of Swanscombe Channel. ~~They are potentially sensitive habitats at the Kent Project Site.~~ Water quality sampling and monitoring will take place at these marshes to understand the water conditions within them and to capture data relating to any impacts on water quality as construction progresses.

~~17.124~~17.126

~~17.125~~17.127 Swanscombe Marine Conservation Zone (MCZ) is a 3 km^2 area of the River Thames bordering and including part of the Kent Project Site on the western side of Swanscombe Peninsula. The area comprising the MCZ can be seen in Figure 17.6.

~~17.126~~17.128 It was designated in May 2019 for the marine habitat and aquatic ecological assets within it, namely i) intertidal mud; and ii) tentacled lagoon worm (*Alkmaria romijni).* There is a requirement for the MCZ to be maintained in favourable condition.

~~17.127~~17.129 The seabed of Swanscombe MCZ is composed largely of shells, pebbles, sands and mud. The tentacled lagoon worms are found in the intertidal and subtidal soft sediments. This small worm is scarce throughout the UK and lives within a tube made of mud in sheltered lagoons and estuaries. They are very vulnerable to changes to the habitats in which they live.

~~17.128~~17.130 Intertidal mud supports the tentacled lagoon worm and is a highly productive ecosystem that provides important feeding grounds for wading and migratory birds.

~~17.129 While not a designated habitat, Black Duck Marsh and Botany Marsh are located on either side of Swanscombe Channel. They are potentially sensitive habitats at the Kent Project Site. Water quality sampling and monitoring will take place at these marshes to understand the water conditions within them and to capture data relating to any impacts on water quality as construction progresses.~~

Drainage

Existing surface water drainage

~~17.130~~17.131 A full description and drawings of the existing drainage infrastructure is provided in the drainage strategy (Appendix 17.2 Section 3) (document reference 6.2.17.2). For the purposes of this chapter, a brief summary is provided below.

Kent Project Site

Existing sub-catchments

~~17.131~~17.132 The Kent Project Site (Main Resort) area is currently drained via a series of manmade drainage ditches and culverts to the River Thames. The area consists of the following sub-catchments, as shown in Figure 17.7.

- South Pit sub-catchment shown in light blue – discharge points A & B;
- Botany Marsh sub-catchment shown in light blue with line hatch – part of South Pit sub-catchment, discharge points A & B;
- Black Duck Marsh sub-catchment shown in yellow – discharge point C;
- Bell Wharf sub-catchment including Bell Wharf and White's Jetty shown in magenta – direct overland runoff to River Thames;
- Broadness Marsh sub-catchments at the north shown in green (direct runoff to River Thames), purple (sumps to leachate treatment plant (LTP)) and red (discharge to Pylon lagoon and pumping to LTP) – some treatment and direct overland runoff to River Thames

The general flow direction is southeast to northwest and is indicated on the plan with the black arrows. The existing rates of runoff from each catchment have been estimated and are presented in Table 17.9.

Table 17.9: Existing rates of runoff within the Kent Project Site (Main Resort) area

Sub-catchment	Area (ha)	Existing rates (l/s)
		1 in 100
South Pit *	65.1	4,560
Botany Marsh	28.1	2,165
Black Duck Marsh	62.3	4,440
Bell Wharf	2.4	53
Broadness Marsh **	41.5	180

* Botany marsh discharges to South Pit. Here the values shown are separated between the two sub-catchments.
**Broadness marsh consists of three sub-catchments: Broadness West (green), Broadness North (purple), and Broadness South (red).

~~17.132~~17.133 A CCTV survey of the Kent Project Site (Main Resort) was undertaken in September 2020. The outputs of the CCTV survey have informed the understanding of the existing sub-catchments.

South Pit sub-catchment

~~17.133~~17.134 The South Pit sub-catchment (shaded light-blue) consists of the central and eastern parts of the Kent Project Site (Main Resort). Swanscombe Channel crosses the site from south to north. Flows to the Swanscombe Channel are understood to be mainly from Eastern Quarry abstraction discharge (230 l/s), dewatering of the HS1 tunnel (approximately 31 l/s) and runoff from the surrounding catchment A planning application (ref: 20/00197/FUL) submitted in February 2020 indicates that flows from the Eastern Quarry development are proposed to be diverted from its current route away from the Swanscombe Channel and discharge directly to the River Thames via a new outfall. Following conversations with the developers of the Eastern Quarry site, Camland Group, it is understood that the flows will be diverted by April 2021 although work on the foul pipe has commenced.

~~17.134~~17.135 The flows from the Swanscombe Channel and South Pit sub-catchment are currently discharged to the River Thames via a 320m long, 1.6m diameter gravity culvert (outfall B in Figure 17.6) within the western area of the Peninsula. The recent CCTV survey and older CCTV information from the EA have indicated that the culvert is partly silted. Emergency discharge is also achieved via a pumped system operated by HS1 (outfall A in Figure 17.7), located north of the gravity culvert (300mm diameter pipe).

Botany Marsh area

~~17.135~~17.136 The area shown with light blue shade and a diagonal hatch indicates the catchment area draining into Botany Marsh. Observations during site visits and a CCTV survey indicate that this area drains towards the northwest and is part of the South Pit sub-catchment.

Black Duck Marsh sub-catchment

~~17.136~~17.137 The Black Duck Marsh sub-catchment (shaded yellow) drains a large area of the west part of the development site. The CCTV surveys were inconclusive in determining the discharge location from Black Duck Marsh to the River Thames. An outfall has been identified within Black Duck Marsh that could potentially connect to outfall C in Figure 17.7. Historic Southern Water (SW) Authority drawings indicate that a pipe has historically connected the Black Duck Marsh to the 1.6m diameter gravity pipe (outfall B in Figure 17.7). It is not currently known if this is still the case.

~~17.137~~17.138 One catchment area is believed to drain via infiltration (shaded orange). The catchment near Bell Wharf (shaded magenta) drains directly to River Thames.

Broadness Marsh sub-catchments

~~17.138~~17.139 Areas to the north of the peninsula have been used historically for disposal of CKD. A surface water collection and treatment system has been put in place to treat any leachate before discharge to the River Thames. Information on the leachate collection system and sumps, treatment and outfall location are presented in Figure 17.8.

~~17.139~~17.140 CMS-Enviro are currently managing the surface water and leachate treatment of the site. They have confirmed that surface water runoff from Broadness South and North sub-catchments in Figure 17.8 are collected via a system of lined French drains and ponds and pumped to the Leachate Treatment Plant (LTP) within the Broadness Marsh area in the north of the peninsula for treatment. The plant is known to be over capacity and cannot cope with the flows from the two catchments.

~~17.140~~17.141 Surface water runoff across Broadness West sub-catchment flows directly to the River Thames towards the northwest.

~~17.141~~17.142 Following treatment of surface water runoff at the LTP, the effluent is discharged below water level to River Thames at White's Jetty (see Figure 17.9).

~~17.142~~17.143 A separate leachate collection and treatment system is in place to serve the areas at the south. A leachate collection drain is installed around the perimeter of the South Pit landfill mound and pumped to the treatment compound for treatment and disposal. The effluent is kept in storage tanks and pumped to the SW sewer pumping station located to the south of the site, as shown in Figure 17.9. If leachate disposal to sewer is not permitted for any reason leachate can be removed from the storage tanks via road going tanker for disposal off site at a suitably licensed disposal facility.

The proposed Access Road

~~17.143~~17.144 The Kent Project Site (Access Road) area will be split into six sub-catchments, as illustrated in Figure 17.10. The existing sub-catchments are described in detail in Section 3.2.3 of the Surface Water Drainage Strategy, Appendix 17.2.

~~17.144~~17.145 The majority of the sub-catchments around the proposed access road are currently greenfield. The general slope of the sub-catchments is northwest to southeast towards the River Ebbsfleet.

~~17.145~~17.146 It is currently understood that the majority of the sub-catchments drain to River Ebbsfleet via ditches and culverts. Site investigations will be undertaken at the next stage of design to confirm the upstream drainage connection to the area, existing drainage regime and outflow systems.

~~17.146~~17.147 There are several existing ponds within the catchments. Their function and contribution to the existing drainage regime is not fully understood at the moment and is under investigation.

Existing drainage infrastructure

~~17.147~~17.148 The following drainage utilities are present within the site boundary:

- A leachate system collects leachate from South Pit area, treats and discharges to the SW foul system.
- A separate leachate system serves Broadness marsh at the north. Treated leachate is discharged at White's Jetty.
- An SW foul system serves the south area of the Kent Project Site. A pump station and rising main are located within the site boundary. There is a decommissioned SW Swanscombe wastewater treatment works at the centre of the site. Refer to the Utilities Statement (7.6) for details.
- Eastern Quarry flows discharge to the River Thames through the site. Flows are conveyed via the Swanscombe Channel. Subject to planning (Ref: 20/00197/FUL) the flows will be diverted around the Kent Project Site by April 2021.
- HS1 ground water (tunnel dewatering) is pumped to the Swanscombe Channel. A pipe and pump discharge water to the River Thames.
- Manor Way and surrounding roads are served by a KCC surface water system. This drains to the Swanscombe Channel.

Kent Project Site – Access Road

~~17.148~~17.149 A review of the information available for the site confirms the presence of two ponds close to the HS1 railway lines within the north and south part of the access road:

- Swanscombe Pond to the north located south of Swanscombe/Northfleet railway tracks and north of Herbert Road's footpath/cycleway;
- an unnamed pond to the south located west of the River Ebbsfleet.

~~17.149~~17.150 A network of ditches and land drains appear to connect some sections of the existing greenfield areas which discharge towards existing culverts.

~~17.150~~17.151 Records collected for the site confirm that part of the Ebbsfleet Gateway (A2260) crossing the site is served by a traditional highway gravity drainage system including road gullies, drains and catchpits. The outlets of the highway drainage system are to be investigated and confirmed.

Essex Project Site

Existing drainage infrastructure

~~17.151~~17.152 East Tilbury Dock Sewer is an EA designated Main River and crosses the Essex Project Site flowing north to south down its western side. It is the main surface water channel that runs south from Tilbury, along St Andrew's road. There are known issues in respect of siltation, which can cause flooding upstream in Tilbury.

~~17.152~~17.153 The site is currently served by a Port of Tilbury surface water network. The network is understood to connect to the East Tilbury Dock Sewer at a gravity outfall sluice. At this point the sewer becomes culverted. The EA has indicated that, due to its condition, the sluice will be sensitive to construction works in the area. The sewer outfalls to the River Thames to the west of the cruise terminal. Figure 17.11 shows the approximate alignment of the East Tilbury Dock Sewer (EA Main River) according to the EA's asset data.

Existing foul water drainage

Kent Project Site

~~17.153~~17.154 The decommissioned Swanscombe wastewater treatment works (WWTW) is located in the centre the Kent Project Site approximately 580 m south-east of Bell Wharf. This disused treatment plant was connected to the residential area to the south of the Kent Project Site via a foul sewer and previously discharged treated sewage effluent to the River Thames via a culvert on the north-west face of the Peninsula. It is proposed that this plant, including the influent and effluent lines, will be demolished and removed as part of the Proposed Development. Refer to the Utilities Statement (7.6) (document reference 7.6) for details.

~~17.154~~17.155 In addition, SW own and operate a sewage pump station on Manor Way, within the Kent Project Site, and rising main that discharges to the Northfleet WWTW. It is understood that this services a catchment area to the west of the site and is currently operational. It is proposed to relocate the pump station and influent mains to the west of Manor Way and re-align the rising main within the extents of the Kent Project Site. This will be completed pursuant to the process in section 185 Water Industry Act 1991 (the S185 process) in agreement with SW. Refer to the Utilities Statement (7.6) (document reference 7.6) for details.

Essex Project Site

~~17.155~~17.156 Existing wastewater mains and infrastructure are located within the Essex Project Site, which is serviced by Anglian Water (AW). At this stage, there are no proposed works to divert or relocate these existing mains. If these mains are impacted by the future works, AW will be consulted to agree a design and sequencing of works, to mitigate any impacts to existing users. This will be completed under the S185 process for agreement. Refer to the Utilities Statement (7.6) (document reference 7.6) for details.

On-site flood risk

~~17.156~~17.157 An FRA (Appendix 17.1) (document reference 6.2.17.1) identifies flood risk from fluvial, tidal, surface water, sewer, artificial and groundwater sources. The assessment considers the frequency and impact of flooding from these different sources.

Kent Project Site

~~17.157~~17.158 The Kent Project Site is located across all three of the EA's flood zones. The northern part of the Swanscombe Peninsula is located within Flood Zone 2 with a large band across the centre of the Peninsula located within Flood Zone 3. The Access Corridor, which comprises the land surrounding the highway network (Access Road) providing access to the peninsula and main park, is located almost entirely within Flood Zone 1.

Figure 17.12 shows the Kent Project Site (Main Resort) straddling the three EA flood zones. It should be noted that the EA flood zone map shows land in the north of the peninsula as being within Flood Zone 2. Although the undefended scenario (which the EA maps are generally based on) has not been assessed as part of this project, review of elevation data and the estimated 1 in 1000 year flood level indicates that this land is higher than the flood defence and other areas of the Swanscombe Peninsula and is unlikely to be in Flood Zone 2.

~~17.158~~17.159 The Swanscombe Peninsula has existing formal flood defences that range in crest level from 6.2 m AOD along the western shore of the Peninsula to 8.8 m AOD along the northern shore. This flood defence level provides the Kent Project Site protection from flooding from tidal sources, which are considered to be the principal risk of flooding to the Kent Project Site, up to the present day 1 in 1000-year (0.1% chance of happening in a year) flood level.

~~17.159~~17.160 These flood defences are constructed largely around the perimeter of the Peninsula, and comprise earth berms (see Figure 17.13) with cement kiln dust cores as well as some limited areas of flood wall and flood gates. At White's Jetty, the flood defences are comprised of concrete flood walls with flood gates for access.

~~17.160~~17.161 Whilst the Kent Project Site currently receives protection from a storm surge up to the 1 in 1000-year flood event, climate change is predicted to result in sea level rise and therefore an increased risk of tidal flooding to the Kent Project Site. From the data provided by the EA, it is anticipated that the current flood defence will be unable to provide the required 1 in 1000-year protection for the lifetime of the project.

~~17.161~~17.162 There is a residual risk to the Kent Project Site from a breach or failure in the existing tidal defences. The probability of a breach in defence is considered low, although the impact would be high.

~~17.162~~17.163 The River Ebbsfleet flows through the Access Corridor of the Kent Project Site in a

broadly northerly direction, discharging into the River Thames. The River Ebbsfleet is a groundwater fed system and therefore may be at risk of flooding in periods of prolonged rainfall when ground water levels are high.

~~17.163~~17.164 As a result of the existing flood defences on the Kent Project Site, the level of flood risk from rivers and the sea is deemed at present to be low but with an increase in risk in the future associated with climate change.

~~17.164~~17.165 The flood risk from groundwater and artificial sources (including reservoirs) is considered to be low.

~~17.165~~17.166 Historic flooding has been recorded for Manor Way from surcharge of the highways drainage system. The surface water and foul drainage strategies have considered this existing risk as part of their strategies. Otherwise, in general surface water and sewer flooding at the Kent Project Site is considered low.

Essex Project Site

~~17.166~~17.167 The Essex Project Site is located entirely within Flood Zone 3, as shown in Figure 17.14 with the area north of the Tilbury Cruise Terminal buildings benefitting from defences.

~~17.167~~17.168 The Essex Project Site has existing flood defences that range in crest level from 6.48 m AOD to 6.71 m AOD. The defences in this location are predominantly flood walls with flood gates for access.

~~17.168~~17.169 The existing flood defences are tied into the terminal buildings at the Tilbury Landing Stage. To the east of the terminal buildings, the defences are steel plate sections bolted onto the southern face brickwork of the adjacent Tilbury Riverside Arts Activity Centre (TRAAC) with a mass concrete fill between the steel plate and the brickwork. These defences then run north east from the TRAAC toward the boundary of the DCO Order Limits, consisting of steel box-sections bolted to the original jetty deck, including a flood gate opening (see Figure 17.15).

~~17.169~~17.170 The EA has confirmed that, as part of the future aspirations of the TE2100 Plan, they are currently investigating a realignment of the existing flood defences within the existing TCT building to along the southern side of Fort road to the north of TCT buildings. The proposal is for an initial crest level of 6.9m AOD, however consideration will be made for the fact that this crest level may require raising at a later date to 8.00m AOD. The design team will work closely with the EA as they develop their proposals for the new flood defences to ensure that an integrated approach to an effective solution can be made.

~~17.170~~17.171 The flood defences at the Essex Project Site provide protection from tidal sources up to the present day 1 in 1000-year flood level.

~~17.171~~17.172 However, as with the Kent Project Site, the impacts of climate change make it likely that the flood defences will be unable to provide the required 1 in 1000-year protection

for the lifetime of the Proposed Development.

~~17.172~~17.173 The Essex Project Site is situated within reclaimed marsh land with low ground elevations, typically between 1-3 m AOD. There is a network of surface water drains which drain the area using a combination of gravity and pumps to outflow into the Thames. There is a risk of flooding from this drainage network should the pumps fail or should the rainfall intensity or volume exceed the pumping capacity for the system.

~~17.173~~17.174 The Essex Project Site is also partially at risk from artificial sources of flooding from the Tilbury Flood Storage Area (FSA) and the Tilbury Docks. A breach of either would cause inundation of part or all of the Essex Project Site. Given the level of maintenance undertaken at both locations, the risk is considered low.

~~17.174~~17.175 The risk from groundwater and sewer flooding at the Essex Project Site is considered to be low.

Water supply and existing demand

Kent Project Site

~~17.175~~17.176 Currently, there is a limited potable water supply network within the Kent Project Site which, with the exception of supply to the HS1 tunnel, currently services the relatively sparse industrial operations. In contrast there is an extensive potable water network within adjacent developed areas such as Greenhithe, Swanscombe and Ebbsfleet. Refer to the Utilities Statement (7.6) (document reference 7.6) for details of existing potable water infrastructure at the Kent Project Site.

~~17.176~~17.177 The Kent Project Site is located within the potable water supply area for both Thames Water and SW. The majority of the Kent Project Site is located within the London Water Resource Zone (WRZ) of the Thames Water Supply Area. The majority of Thames Water's water supply is derived from surface water abstraction from the River Thames (including the Lower Thames) and the remainder is derived from groundwater abstraction.

~~17.177~~17.178 Thames Water's current Water Resource Management Plan (WRMP) was published in 2019 (also known as Thames Water WRMP19) and covers the period from 2019 through to 2100. It highlights the growing deficit in the supply-demand balance of the London WRZ.

~~17.178~~17.179 It forecasts a growing deficit on a dry year annual average, changing from -24 Ml/d in 2020 to -195 Ml/d in 2030 and -362 Ml/d in 2045. The increasing deficit in the long-term is driven primarily by increases in demand and allowance for planning uncertainties (target headroom).

~~17.179~~17.180 Thames Water‘s existing water distribution mains together with a 600mm trunk main, are located within the Kent Project Site. Distribution mains within the development

area service plots, which are being removed as part of the Proposed Development, and these will be removed in agreement with Thames Water. The 600mm trunk main supplies the HS1 tunnel. It is proposed to divert the trunk main within the development area through a S185 agreement with Thames Water, whilst maintaining supply to the HS1 tunnel.

~~17.180~~17.181 The SW service area covers only the eastern edge of the Kent Project Site. The SW WRMP was also published in 2019. It covers the period from 2020 to 2070. The WRMP describes the majority of the supply region as 'seriously water stressed'. Key features of the WRMP include the 'target 100' campaign, to bring personal water use down from 130 to 100 litres per person per day by 2040.

Essex Project Site

~~17.181~~17.182 Potable water at the Essex Project Site is served by Essex and Suffolk Water (ESW).

~~17.182~~17.183 The current land use within the Essex Project Site order limits comprises a car park, several small commercial buildings, and the Tilbury Landing Stage. Existing daily potable water demand for the Essex Project Site is considered low.

~~17.183~~17.184 Existing potable water distribution mains are located within the Essex Project Site. Refer to the Utilities Statement (document reference 7.6) for details of existing potable water infrastructure at the Essex Project Site. At this stage, there are no proposed works to divert or relocate these existing mains. If these mains are later determined to be impacted by the works, ESW will be consulted to agree a design and sequencing of works, to mitigate any impacts to existing users through a S185 agreement with ESW.

~~17.184~~17.185 ESW has been engaged through the pre-planning process and confirmed that supply is available to the site. Refer to the Utilities Statement (document reference 7.6) for details.

Water quality

~~17.185~~17.186 A Water Framework Directive (WFD) assessment has been undertaken and is submitted as a stand-alone document and is appended to Chapter 13 Marine Ecology and Biodiversity (document reference 6.2.13.7). This section presents a summary of the water quality status within the principal water bodies relevant to the assessment, as identified in the WFD assessment.

~~17.186~~17.187 Surface water drainage within the Peninsula of the Kent Project Site currently discharges into the River Thames, principally through the Swanscombe Channel. Surface water in the Essex Project Site principally discharges to the River Thames through East Tilbury Dock Sewer. Surface water draining into the River Ebbsfleet to the south east of the Swanscombe Peninsula also discharges into the River Thames. There is potential for on-site activities to influence the water quality of these water bodies through connections

and proximity both during construction and connections during the operational phase of the development.

~~17.187~~17.188 The European Union WFD was transposed into law in England and Wales through the Water Environment WFD (England and Wales) Regulations 2003, which have subsequently been repealed and replaced by the WFD (England and Wales) Regulations 2017. The aim of this Directive is to provide an integrated, Europe-wide approach to the management of water resources, particularly water quality. As part of the Directive, River Basin Management Plans have been established. These are updated with each new WFD Cycle. Cycle 1 began in 2009 and ran to 2015, Cycle 2 began in 2015 and runs to 2021.

Main water bodies

River Thames

~~17.188~~17.189 The River Thames falls within the Thames River Basin District. The associated River Basin Management Plan establishes a number of requirements that must be met to comply with the WFD.

The River Thames, at the location adjacent to the Project Site, falls within the Middle River Thames catchment. It is transitional water and is classified as heavily modified under the WFD. There is an obligation to achieve 'good ecological potential'. By definition, artificial and heavily modified water bodies are not able to achieve natural conditions. Instead the classification and objectives for these water bodies, and the biology and habitat structure that they provide, are measured against ecological potential rather than status.

~~17.189~~17.190 In Cycle 2, which is the current WFD Cycle (Cycle 1 having ended in 2015, and Cycle 2 due to end in 2021) the ecological status of the River Thames at this location is classified as 'moderate'. The chemical status of the River Thames at this location is classified as 'fail'. The overall water body classification for the River Thames at this location is 'moderate'.

Table 17.10: WFD classification of the Middle River Thames (EA Catchment Data Explorer, accessed: 14/12/2020).

Classification Item	2013	2014	2015	2016	2019
Overall Water Body	Moderate	Moderate	Moderate	Moderate	Moderate
Ecological	Moderate	Moderate	Moderate	Moderate	Moderate
Chemical	Fail	Fail	Good	Fail	Fail

~~17.190~~17.191 The main causes that are determining existing status of the water body relate the following key elements:

- Chemical Status – FAIL
    - Fail for the level of tributyltin compounds

- Ecological Status – MODERATE
  - Moderate biological quality of angiosperms
  - Moderate levels of dissolved inorganic nitrogen
  - Moderate levels of dissolved oxygen
  - Moderate levels of zinc pollutants

~~17.191~~17.192 Based on the EA's findings, the key issue preventing the water body achieving a good status is pollution from the water industry. This is represented in the form of wastewater pollution, physical modifications to the water course by local and central government and pollution from towns, cities and transportation.

River Ebbsfleet

~~17.192~~17.193 The River Ebbsfleet was included in Cycle 1 (up to 2015) of the Thames River Basin District River Basin Management Plan but was not included in Cycle 2 following a review of which waterbodies to continue forward into that cycle. It means that no recent water body classifications for the River Ebbsfleet are available. The River Ebbsfleet was classified as heavily modified under the Directive. In Cycle 1 it was classified as having 'moderate ecological potential' and was expected to maintain this status into 2015. Classification of chemical quality for the river was not deemed a requirement.

Water quality sampling

~~17.193~~17.194 Water quality testing is being undertaken on the Kent Project Site using manual sample collection and laboratory analysis. The monitoring locations and the analytical parameters have been agreed with the EA. Water quality testing will be undertaken on a monthly basis. The testing will continue on a monthly basis until October 2021 to provide a full year of information which will be made available to the EA during this period and the design may be modified to reflect this. A broad range of parameters will be tested for initially, and the testing suite refined over time. For surface water sampling locations, sediment sampling is also being undertaken.

~~17.194~~17.195 Preliminary results undertaken to date are discussed further in Appendix ~~17.3~~18.20 ~~*Surface Water Quality Testing*~~*Buro Happold (2021) ~~document reference 6.2~~London Resort Water environment – interim monitoring report* (Document Ref. TBC).~~17.3).~~

~~17.195~~17.196 Water quality surveys are not proposed to be undertaken within the Essex Project Site as no sensitive habitats have been identified within the Site location.

Hydromorphology and marine infrastructure

Current marine infrastructure

~~17.196~~17.197 The changes to the marine infrastructure at both Project Sites, and river use at this stage of the River Thames have the potential to impact on the hydromorphology of the River Thames and riparian areas. This section presents the current marine infrastructure within both Kent and Essex Project Sites.

Kent Project Site

~~17.197~~17.198 Within the order limits at the Kent Project Site are two existing elements of maritime infrastructure in the form of White's Jetty and Bell Wharf. In addition to these, there is St Clements anchorage, which includes two fixed mooring buoys within the order limits located on the most northern tip of peninsula at Broadness Point Light. The locations of these features are shown in Figure 17.16, along with other maritime infrastructure assets such as Broadness Harbour, the River Thames Navigation Channel and the operational wharves along the eastern boundary of the Swanscombe Peninsula.

For the purpose of this assessment, the key elements of infrastructure that will be covered are Bell Wharf and White's Jetty. Both structures provided access to the River Thames from the Swanscombe Peninsula but have fallen into states of disrepair. To ascertain their potential for re-use, a structural inspection was undertaken by Eastwood & Partners in July 2013. The conclusions of these inspections are summarised below:

<u>White's Jetty</u>

~~17.198~~17.199 White's Jetty is a y-shaped, reinforced concrete jetty structure supported by circular concrete piles, and covers an approximate area of 3,200 sqm extending into the river and along the southern bank of the River Thames.

~~17.199~~17.200 White's Jetty is considered to be in very poor condition. The main concern with the structure is the extensive spalling and corrosion of the deck support beams that have led to a significant weakening of the structure. Other concerns relate to extensive vegetation growth within deck joints, shrinkage cracking in the deck slabs, spalling and corrosion of reinforcement within the supporting piles and decayed timber fendering used for the berthing of vessels.

~~17.200~~17.201 Due to the severe level of degradation, loading of the deck with vehicular traffic was not recommended.

~~17.201~~17.202 The possibility of repairing the structure was assessed but it was not deemed to be cost effective and instead recommended it to be demolished and replaced if required. The possibility of reusing the support piles was raised but this would require further investigation.

<u>Bell Wharf</u>

~~17.202~~17.203 Bell Wharf is a 12m wide and 160m long reinforced concrete deck structure supported on concrete piles. It is understood to have been used for loading and unloading

materials when the Channel Tunnel rail link was under construction. Bell Wharf is described to be in fair to poor condition.

~~17.203~~17.204 Concerns on the structure relate to significant cracking and spalling of the concrete deck and piles. Both of which are believed to contribute to a significant weakening of the structure.

~~17.204~~17.205 Subject to further inspection, it was deemed possible to repair the structure, but it was expected that the repairs would be extensive, and the report recommended that replacement was budgeted for.

~~17.205~~ It should be noted that White's Jetty and Bell Wharf were inspected during 2013. Over the past seven years the structures will have decayed further and additional investigations will be required to establish the viability of bringing, particularly Bell Wharf, into a suitable condition for future use and we are considering other options.

17.206

Essex Project Site

~~17.206~~17.207 One existing element of maritime infrastructure is located within the order limits at the Essex project site. This is the Tilbury Landing Stage, the location of which is shown in Figure 17.17, along with other marine infrastructure.

~~17.207~~17.208 Tilbury Landing Stage is an operational facility that is used by/for:

- London Cruise Terminal;
- Port of London Authority Pilot Cutter;
- Tilbury to Gravesend ferry service (service currently provide by Jetstream Tours); and
- dedicated terminal, which opened in the year 2000 for the specific use of handling imported motor vehicles.

~~17.208~~17.209 Tilbury Landing Stage is approximately 25m wide and 350m long, the deck is a concrete floating pontoon. It is assumed that, given the current operations taking place on the Tilbury Landing Stage, the condition of the structure is sound. No detailed inspection has taken place.

~~17.209~~17.210 A dedicated terminal is located on the western end of the pontoon and includes a series of dolphins (berthing or mooring structures) that extend approximately 270m upstream from the end of the Tilbury Landing Stage.

~~17.210~~17.211 At the downstream part of the Tilbury Landing Stage there is an existing ferry connection from the Tilbury Landing Stage to a Ferry Terminal at Gravesend, on the south side of the Thames. There is an existing car parking area on the Tilbury Landing Stage

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associated with the Ferry crossing.

Hydrodynamics and Sedimentation

~~17.211~~17.212 The Hydrodynamic and Sedimentation Assessment (Appendix 17.4) (document reference 6.2.17.4) contains detailed information on the hydrodynamic baseline of the River Thames in the vicinity of the Project Site. A summary is presented here.

~~17.212~~17.213 The existing layout for both the Kent and Essex Project Sites was modelled as a baseline to allow a comparison of the various options to be reviewed against. At the Kent Project Site the structures considered were Bell Wharf and White's Jetty. At the Essex Project Site the structure considered were the Landing Stage.

Hydrodynamics

Kent Project Site

~~17.213~~17.214 The baseline hydrodynamics at the Kent Project Site are relatively complex with a large eddy formed directly adjacent to Bell Wharf and Whites Jetty on the west side of the peninsular during the flood tide. Meaning that the currents at the Kent Project Site will be predominantly towards the north east. The maximum peak currents of more than 2m/s which is observed in the middle of the channel at both the times of peak ebb and flood tide.

~~17.214~~17.215 Figures 17.18 and 17.19 present the hydrodynamic baseline at the Kent Project Site during peak ebb and flood tide.

~~17.215~~17.216 In addition to the three options for the proposed development marine infrastructure at the Kent Project Site the hydrodynamic assessment included a review into the creation of new habitat around the headland of Swanscombe Peninsula. The assessment included approximately 2.0 ha of intertidal habitat through the creation of six new embayment areas of setback as shown in Figure 17.20, which were included in the modelling for all options at the Kent Project Site.

Essex Project Site

~~17.216~~17.217 At the Essex Project Site the currents are almost in line with the flood and ebb currents going in the opposite directions. The maximum peak currents almost reach 2m/s for both the ebb and flood tides in the middle of the channel.

~~17.217~~17.218 Figure 17.21 and 17.22 present the hydrodynamic baseline at the Essex Project Site during peak ebb and flood tide.

Sedimentation

Kent Project Site

~~17.218~~17.219 The bed material schematisation at the Kent Project Site shows that mix of sediments is expected to be present with low enough bed shear stresses to allow sediment accretion of fine sediment to occur along the riverbanks. The bed shear stress increase towards the channel with the material expect to become coarser ranging between 10 – 20mm (gravel). Adjacent to Bells Wharf fine sediment is indicated with the remaining area being a mix of sand and gravel up to a diameter of 5mm.

~~17.219~~17.220 Figure 17.23 presents the baseline patterns of erosion and deposition at the Kent Project Site.

Essex Project Site

~~17.220~~17.221 At the Essex Project Site the channel is shown as gravel 5-10 mm. Towards the vicinity of the east side of the Landing Stage sand and fine gravel is predicted. Close to the river bank some fine sediment settling is predicted.

~~17.221~~17.222 Figure 17.24 presents the baseline patterns for erosion and deposition at the Essex Project Site.

FUTURE BASELINE

~~17.222~~17.223 The future baseline anticipates the conditions expected on the Essex Project Site in the future in the absence of any Proposed Development coming forward. It considers the expected status and condition of the water resources and marine infrastructure on-site in the year 2029 – the first year of planned full operation of the Proposed Development.

~~17.223~~17.224 The future baseline is likely to be similar to the current baseline, given the relatively short period of time under consideration.

River Thames and surface water features

~~17.224~~17.225 The condition of the River Thames will need to be continually monitored and improved to achieve the requirements of the WFD. Once the requirements are met, they will need to be maintained. The River Thames will therefore retain its classification as highly sensitive.

~~17.225~~17.226 According to the EA Catchment Management tool, the Middle River Thames is expected to reach its objective of 'good' by the year 2027.

Table 17.11 Objectives for the River Thames (Middle) which must be achieved (EA Catchment Management tool. Accessed 14/12/20).

Classification Item	Status	Year	Reasons
Supporting elements (Surface Water)	Good	2027	Disproportionate burdens
Mitigation Measures Assessment	Good	2027	Disproportionate burdens
Dissolved oxygen	Good	2027	Disproportionate burdens
Specific pollutants	High	2027	Cause of adverse impact unknown
Zinc	High	2027	Cause of adverse impact unknown

~~17.226~~17.227 Other surface water features identified are expected to remain in a similar condition to their current status and will therefore retain their sensitivities.

Surface water drainage

Kent Project Site

~~17.227~~17.228 Eastern Quarry flows currently discharge to River Thames via the Swanscombe Channel (EA designated Main River). Subject to planning (Ref: 20/00197/FUL), the flows will be diverted around the Kent Project Site by April 2021. Following conversations with the developers of the Eastern Quarry site, Camland Group, it is understood that the flows will be diverted by April 2021 although work on the foul pipe has commenced.

~~17.228~~17.229 The Eastern Quarry flows are believed to be the main contributor of water to the Swanscombe Channel during normal flow conditions (230 l/s), along with flows from dewatering of the HS1 tunnel (~31 l/s). The diversion of the flows could potentially result in lowering of water levels within the Channel.

Essex Project Site

~~17.229~~17.230 No changes are anticipated within the Essex Project Site in terms of surface water.

Flood Risk

~~17.230~~17.231 Flood risk will still need to be managed through the implementation of the principles of NPPF. The guidance document 'Flood risk assessments: climate change allowances', published by the EA in February 2016, provides estimated peak rainfall intensities and peak river flows based on UKCP09 projections. In December 2019, the guidance was updated to provide estimates on sea level rise based on the UKCP18 projections. Updates to the peak river flow and peak rainfall intensities based on the UKCP18 projections are forecast to be published before the end of 2020. The guidance was further updated in July 2020 with guidance relating to use of High ++ allowances in developments. The H++ scenario relates to an extreme climate change scenario on the margins, or outside of the 10th to 90th percentile range presented in the UKCP18 climate change projections. The NPPF guidance contains sensitivity ranges that are recommended

to be applied to peak rainfall intensities, peak river flows, sea level rise, offshore wind speeds and extreme wave heights. The general trend is for each parameter to increase in the future, which in turn increases the risk of flooding to any site. The recommended allowances for peak rainfall intensity are given in Table 17.12.

Table 17.12: Recommended climate change allowances for peak rainfall intensity.

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

~~17.231~~17.232 Sea levels are also likely to rise in the future. The recommended allowances for sea level rise as provided in the NPPF are given in Table 17.13.

Table 17.13 Sea level allowance for each epoch in millimetres (mm) per year for the south east.

Allowance Category	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (m)
Higher central	5.7	8.7	11.6	13.1	1.2
Upper end	6.9	11.3	15.8	18.2	1.6

~~17.232~~17.233 Sea level rise in the H++ scenario has been estimated for the period up to 2100. Table 17.14 shows the single annual allowance for H++. There is no H++ value beyond 2100.

Table 17.14: Single annual allowance for H++ scenario

Allowance Category	Total sea level rise to 2100 (m)
H++ scenario	1.9

Water supply

Kent Project Site

~~17.233~~17.234 The TW London WRZ has a growing deficit and it highlights that substantial demand management programme is required to maintain a surplus to headroom through

TW Asset Management Period 7 (AMP7) (2020-2025).

~~17.234~~17.235 The TW WRMP (2020-2100) also highlights a growing water supply deficit. It estimates that whilst London will have a water surplus in 2019/20, demand will exceed supply from the beginning of 2020. This deficit is created by increased population, exacerbated by climate change and exports to neighbouring water companies. There are a number of strategies outlined within the WRMP, which include substantial demand management in the short term and a number of options for resource management in the medium-long term. However, the potential impacts from climate change and the forecast increases to population mean that the sensitivity of water supply is likely to remain high.

~~17.235~~17.236 In accord with the TW WRMP, the SW WRMP also describes the area as mostly seriously water stressed and places an emphasis on managing demand into the future. Again, this is predominantly driven by population increase and climate change.

Essex Project Site

~~17.236~~17.237 Essex and Suffolk Water's WRMP was published in August 2019 and covers the period 2019 through to 2060. It forecasts that a surplus of water can be maintained through this period, with dry-year annual average increasing from 13 Ml/d in 2020 through to 21 Ml/d in 2030 and 39 Ml/d in 2045. This indicates an increasing surplus over the period.

Hydromorphology and marine infrastructure

Marine infrastructure

Kent Project Site

~~17.237~~17.238 Bell Wharf and White's Jetty are not in use and it is assumed their condition will continue to deteriorate.

Essex Project Site

~~17.238~~17.239 The Tilbury Landing Stage is an asset maintained by the Port of Tilbury. Regular maintenance is expected to be undertaken. Expansion of the Tilbury Landing Stage may be considered in the future, even without the Proposed Development, given the increasing use of the River Thames as a transport route.

Hydromorphology and sedimentation

Kent Project Site

~~17.239~~17.240 If not maintained, deterioration and ultimate collapse of Bell Wharf and White's Jetty would result in a slight change to the hydrodynamic and sedimentation regime on

the western side of Swanscombe Peninsula, however the struts and supports which are within the water column may remain in some form long after the above-water structure has collapsed. Modelling would need to be carried out to assess the extent of change in a scenario where marine infrastructure has been removed or partly removed.

Essex Project Site

~~17.240~~17.241 The Tilbury Landing Stage is an asset maintained by the Port of Tilbury. Regular maintenance is expected to be undertaken. Expansion of the Tilbury Landing Stage may be considered in the future, even without the Proposed Development, given the increasing use of the River Thames as a transport route.

POTENTIAL SIGNIFICANT ENVIRONMENTAL EFFECTS OF THE PROPOSAL

Identified receptors and their sensitivity

~~17.241~~17.242 Potential receptors have been identified through the assessment of baseline conditions – in particular drainage regimes and hydrological links between sources of potential impact and water bodies or where they are close enough to be susceptible to impacts of windborne pollution (dust and debris).

~~17.242~~17.243 Sensitivities have been applied as indicated in Table 17.15.

Table 17.15: List of sensitive receptors and sensitivities.

Receptor		Sensitivity	Justification
Kent Project Site			
River Thames	Water quality	High	Failing to meet the quality standards (ecological status) of the WFD. Marine Conservation Zone (MCZ) in River Thames adjacent to Swanscombe Peninsula
Black Duck Marsh and Botany Marsh including Swanscombe Channel	Water quality	High	Wetland marshes within Swanscombe Peninsula SSSI and including Swanscombe Channel draining into the River Thames.
River Ebbsfleet	Water quality	High	Achieving only 'moderate' ecological potential in Cycle 1 of WFD.
Sawyer's Lake	Water quality	High	Water body of aesthetical and recreational value

Receptor		Sensitivity	Justification
Castle Hill Lake	Water quality	High	Water body of aesthetical and recreational value
Water services infrastructure (surface water)	Capacity	High	On site drainage infrastructure should be appropriately sized. Existing network and sewerage will need to be protected from sediment during construction.
Water services infrastructure (supply)		High	The region is under serious water stress. The WRMPs have identified a growing water supply deficit.
Water services infrastructure (foul treatment)		Moderate	SW sewerage network and Northfleet WWTW do not have capacity for the foul water management demand created by the Proposed Development.
Proposed on-site WWTW		Low	Sewerage network connecting to proposed bespoke WWTW designed to manage wastewater from the Kent Project Site.
Site users		High	Demolition and construction site workers and site users during operation.
Hydromorphological features		High	Riverbed and riparian areas sensitive to changes in river regime and marine infrastructure.
Essex Project Site			
River Thames	Water quality	High	Failing to meet the quality standards (ecological status) of the WFD.
East Tilbury Dock Sewer	Water quality	High	EA Main River watercourse that drains surface water. Connects to River Thames in south west of Essex Site.
Pinnocks Trough	Water quality	Low	Surface water drainage channel running adjacent to eastern boundary of Essex Project Site.
Water services infrastructure (surface water)	Capacity	High	On site drainage infrastructure should be appropriately sized. Existing network and sewerage will need to be protected from sediment during construction.
Water services infrastructure (supply)		High	The WRMP has identified a growing water supply deficit.

Receptor	Sensitivity	Justification
Water services infrastructure (foul treatment)	Moderate	Water services infrastructure needs to be able to deal with population growth and reduce pollution incidents to the River Thames.
Site users	High	Demolition and construction site workers and site users during operation.
Hydromorphological features	High	Riverbed and riparian areas sensitive to changes in river regime and marine infrastructure.

Demolition and construction effects

Relevant aspects of the scheme

~~17.243~~17.244 The following section sets out key elements and process of the construction phase of the Proposed Development relevant to Water Resources and Flood Risk.

Construction process

Marshland areas

~~17.244~~17.245 The proposals for development of the peninsula mean some of the marshland area will be built on or landscaped to enhance and connect marshland and habitats. The landscape of the Swanscombe Peninsula will be enhanced through water quality and habitat enhancements as well as improved public access, connectivity and facilities. A Landscape and Ecology Management Plan (Appendix 11.8) (document reference 6.2.11.8) aims to interrupt the current ecological succession to maintain open mosaic habitat on the peninsula as well as grassland and scrub. Water quality and wet habitat will also be improved with an upgraded leachate treatment system, a new system of reedbeds and ditches, ponds and scrapes as well as an extension to the salt marsh habitat around the edge of the peninsula.

~~17.245~~17.246 Black Duck and Botany Marshes have high ecological value overall but are degraded in parts. They will be enhanced through a targeted management regime. A network of drainage ditches currently crosses the peninsula and form distinct edge conditions along marshland areas. These will be retained wherever possible.

~~17.246~~17.247 The Swanscombe Channel will be diverted alongside Pilgrims Way and discharge into Black Duck Marsh. The Central Pond, to the north of Black Duck Marsh, and the ponds by the HS1 tunnel, in the western area of Botany Marsh will be removed as part of the Proposed Development. These currently have poor amenity value. As they do not form

part of the proposed development and will be removed, they are not considered as part of this assessment. Replacement enhanced wetland areas are proposed as described below.

~~17.247~~17.248 The overarching objective at Botany Marsh is to improve the condition and diversity of the habitat and create a wetter environment. An extensive network of new ditches will be formed with the intention of creating new habitats, and wet woodland and scrub that can thrive in waterlogged areas alongside the resort edge will provide additional vertical screening and natural security.

~~17.248~~17.249 The scrub mosaic habitat on Broadness Marsh will be retained and enhanced through a new management regime, and an extended saltmarsh habitat will be formed along the north edge of the peninsula bordering Broadness Marsh through re-profiling the riverbank and retiring of old flood defences.

~~17.249~~17.250 Figure 17.25 shows proposed landscaping and marshland areas.

Marine infrastructure

~~17.250~~17.251 It is proposed to use the River Thames as much as possible to support the import of construction materials and export of construction waste in order to reduce the impacts on the local road network and local communities.

~~17.251~~17.252 **Kent Project Site:** At this stage, ~~three~~ two design options are being progressed for Swanscombe Peninsula, with a view to confirming a preferred option upon completion of further studies to be undertaken in parallel with the DCO process. This approach has been discussed and agreed with the Port of London Authority (PLA) and Marine Management Organisation (MMO) as well as other local stakeholders. The ~~three~~ two options (A and~~,~~ ~~B and C~~) are summarised below in Table 17.16 and depicted in Figures 17.26 and~~,~~ 17.27 ~~and 17.28 respectively~~.

Table 17.16: Design options at Swanscombe Peninsula

Option	Works packages			Figure
A	New ferry pontoon with linkspan (not required as part of enabling works)	Refurbishment of Bell Wharf – an open-piled quay deck	Construction of a new floating barge offloading facility and access bridge. ~~roll-on/roll-off platform and linkspan~~	17.2~~1~~6
B	New ferry pontoon with linkspan (not required as part of enabling works)	Refurbishment of Bell Wharf – an open-piled quay deck	Refurbishment/reinforcement of White Jetty – an open-piled deck structure in an uncertain state of repair	17.2~~1~~7

~~C~~	~~New ferry pontoon with linkspan (not required as part of enabling works)~~	~~Refurbishment of Bell Wharf – an open-piled quay deck~~	~~Dredging to deepen access to Bell Wharf~~	~~17.18~~

~~17.252~~17.253 **Essex Project Site:** At the Port of Tilbury, it is proposed to provide a new ferry pontoon with a linkspan. This is shown in Figure 17.28.

~~17.253~~17.254 The construction methodology required for the formation of these options will include:

- **Floating pontoons and guide piles** – For passenger ferry access through all tidal levels, a floating pontoon with linkspan ramps will be required. This will require a series of 'guide piles' to be driven or bored. It is most likely this piling would be undertaken using an anchored or 'spud' barge. The type of piles will be determined through future ground investigation works. Floating pontoons will then be attached to the piles. The pontoons will likely be constructed off-site, and installed from a floating or anchored barge. Some final finishing such as surfacing, balustrades and signage may be installed in-situ.

- **Linkspan installation** – Linkspans are a ramp linking the floating pontoons to a fixed structure or the shoreline. They adjust in gradient according to the state of the tide. These elements will be constructed off-site and delivered either by barge or lorry (in sections) to the Project Site. They will then be craned into position from either the land or the River Thames depending on access requirements. Crane capacity will be determined for each of the options, with Option A requiring very significant crane capacity.

- **Works to existing open-piled structures** – Such works to existing structures will depend on the option pursued and the outcome of structural surveys. Typical works for refurbishment of steel structures will be shot-blasting, possibly plating, and repainting. Reinforced concrete structures might require new casting to increase cover depths to steel. Such works must be undertaken in the dry, and so dewatering of the structures and their immediate environment will be required combined with encasement of the underneath of the structures. This could be through temporary sheetpiling or the installation of a bund with a diaphragm wall.

- **Strengthening of the structures** – This would likely include the installation of additional piles and superstructure. This would require anchored barge access to provide the working platform.

~~**Dredging** – Excavation of the riverbed can be achieved by a number of techniques that will depend on the ground conditions to be confirmed by further investigations. The task can be undertaken using floating vessels, either anchored barges with mounted excavators or specialised dredging vessels, or by dewatering~~

~~the area through use of a bund of sheetpiling, and excavation undertaken using standard land based equipment. The excavated material will either be disposed of in a licensed offshore spoil area, or, if possible, used beneficially in either the works for this site or others. For the purposes of this assessment, it has been assumed that dredging will be undertaken using backhoe dredgers and associated hopper barges.~~

~~17.254~~17.255 The overall strategy will be to utilise the River Thames for delivery and removal of as much material as possible. The Principal Contractor will seek to maximise this percentage to ensure the minimum use of the existing road network. In progressing along this route, the aim will be to deliver at least 80% of construction materials using the River Thames.

~~17.255~~17.256 Bell Wharf on Swanscombe Peninsula will be utilised. The Wharf will be used for waste and logistics while the new passenger terminal will provide access to the London Resort via the River Thames for visitors and staff from central London or the Port of Tilbury. Bell Wharf will be refurbished to enable its utilisation for the first phase of construction. In the first two plus years of the construction it is anticipated that Bell Wharf will be the primary point for materials delivery, receiving approximately 40 to 50% of all incoming components and materials. It will have limited operating windows due to the river's tidal cycles. However, it will provide an important access point, both from and to the Proposed Development.

Hydrodynamic change

~~17.256~~17.257 The Hydrodynamic and Sedimentation Assessment (Appendix 17.4) (document reference 6.2.17.4) has assessed each of the potential marine infrastructure options as presented in the Marine Infrastructure section above, to assess the likely impacts on the hydrodynamic regime. The Hydrodynamic and Sedimentation Assessment assesses three option (A, B and C), however since the assessment was carried out, option C has been discounted and so only Options A and B are relevant and are discussed below.

~~17.257~~17.258 A summary of the modelled impacts is presented below.

Kent Project Site

~~17.258~~17.259 **Option A**: At the time of peak ebb tide the model predicted a speed reduction of greater than 0.05 m/s over a distance of 800 m. The area with the largest change in current speeds predicted a reduction of greater than 0.1 m/s over a distance of 400 m due to the introduction of the two pontoons and the drag effect of the piles. Similar speed reductions were observed during the time of peak flood tide, but the distances were reduced to 600 m and 300 m respectively.

~~17.259~~17.260 **Option B**: At the time of peak ebb tide the model predicted a speed reduction of greater than 0.05 m/s over a 400 m distance. The area with the largest change in current speeds predicted a reduction of greater than 0.1 m/s but only over a few small spots close to White's Jetty. Similar speed reductions and distances were observed during the time of

peak flood tide. It is noted that the effects of Option B are noticeably reduced compared to Option A.

~~17.260 **Option C**: The addition of the dredge area results in an increased area of the speed reduction over the increased water depth due to the deepening. At the time of peak ebb tide the model predicted a speed reduction of greater than 0.05 m/s over a 700 m distance. The area with the largest change in current speeds predicted a reduction of greater than 0.2 m/s is located over the dredged area and extends from the passenger pontoon to White's Jetty. At the time of peak flood tide the model predicted a reduced speed of greater than 0.05 m over a 600 m distance and a 0.1 m/s reduction over a 500m distance.~~

17.261 In addition, the area of habitat creation on the north-west point of the peninsula has also been assessed for changes to hydrodynamic regime. The modelling ~~, as shown in Figure 17.29,~~ shows there are small spots of speed increase located at the new breaches into the habitat creation areas for the ebb tide. However, at the time of peak flood the water level is closer to high water when the habitat areas are inundated. These small areas of increase are surrounded by areas of speed decrease due to the interaction of the passing flow with that entering the habitat areas. These effects are limited to the immediate vicinity of the habitat creation areas. Similar current change patterns were observed for ~~all~~ both options.

17.262 ~~Figure 17.29 and Figure 17.30 show hydrodynamic changes under Option C, which modelling has shown to have the largest effect on hydrodynamics including the greatest footprint of change, during peak ebb and flood tide.~~ Figures showing modelled results of Options A and B are shown in Appendix 17.4 (document reference 6.2.17.4).

Essex Project Site

17.263 At the Essex Project Site, at the time of peak ebb there is an area of speed reduction to the east of the Proposed Development area extending approx. 200 m. There is a small area of increased speed greater than 0.05 m to the north of the development. The impact of this increase is not thought to have any effect on the morphology at this location. At the time of peak flood tide only speed reductions are predicted which are predominantly observed below the existing Landing Stage.

17.264 Figure 17.29~~31~~ and Figure 17.30~~2~~ show modelled hydrodynamic changes at the Essex Project Site as a result of the proposed marine infrastructure changes during peak ebb and peak flood tide.

Sedimentation, erosion and deposition

17.265 The Hydrodynamic and Sedimentation Assessment (Appendix 17.4) (document reference 6.2.17.4) has assessed each of the potential marine infrastructure options as presented in the Marine Infrastructure section above, to assess the likely impacts on sedimentation, erosion and deposition.

17.266 The modelling showed that the proposed marine infrastructure options resulted in change

to sedimentation, erosion and deposition. The scale of the developments proposed is not anticipated to pose any widespread effect on the fin sediment regime of the area at either the Kent or Essex Project Sites.

17.267 More details can be found in the Hydrodynamic and Sedimentation Assessment (Appendix 17.4) (document reference 6.2.17.4).

Enhanced flood defences

17.268 To protect the Swanscombe Peninsula from tidal flooding from the River Thames in accordance with the recommendations of the FRA (Appendix 17.1) (document reference 6.2.17.1), it will be necessary to construct new defences and in places raise existing defences in line with assessed level requirements. This will include the following activities to be undertaken:

- Create an access / haul road and working area 10 metres wide on the landside of existing tidal defences.
- Removal of 250mm-300mm of topsoil from the top of the existing flood bank and the landward slope;
- Drive new outfalls through the bank and create any structural headwall/outfall features.
- Place cohesive fill in layers until the finished design flood defence level and slope extents achieved;
- Apply the approved planting and habitat restoration measures;
- Remove the temporary haul road, aerate the compacted sub-layer, replace the topsoil and trim to final profile.

17.269 Before the new flood defence embankment is constructed, operation of the existing flood gates at Bell Wharf will be required. A condition survey of the existing defences will be undertaken prior to construction for the Project. This will inform the construction flood risk management plan, which will need to be completed by the Principal Contractor. The Flood Risk Management Plan will include details of additional flood mitigation measures that may be required, such as: responsibilities and timings for operation of the floodgates; flood warning systems and method of disseminating information; use of stockpile material providing reinforcement behind floodgates if required after a flood warning; identification of safe emergency and evacuation routes; safe working practices by water; keeping stockpile material at least 8m away from river edge; risk of groundwater flooding basement/lower ground level excavations; impact of breach and locations of accumulated flows; location of surface water balancing facilities; and details of temporary drainage measures required to reduce pollution and not increase flood risk at the site/offsite areas.

~~17.269~~17.270 Any works undertaken within, under or over a main river and other activities on the main river flood plain (within 8 metres from the river bank, culvert or flood defence structure, or 16 metres if it is a tidal main river), or near a main river or the sea that may affect flood risk, will require an Environmental Permit from the EA. This permit replaces the previous Flood Defence Consents issued before the 2016 No. 1154 Environmental Permitting (England and Wales) Regulations 2016. A permit would be required for works undertaken near the River Thames, the Swanscombe Channel and the River Ebbsfleet. A flood risk permit is not required from the EA for works on 'ordinary watercourses'– usually small rivers, streams and ditches. Although the local council may need to be consulted to check if a land drainage consent is required. Details for activities requiring an Environmental Permit can be found at the EA website https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

Surface water drainage

~~17.270~~17.271 Where possible all drainage runs, manholes and ancillary items would be located within one trench to promote the coordinated delivery of underground infrastructure.

~~17.271~~17.272 Surface water drainage will be discharged at appropriate and agreed rates to existing water courses, landscaped areas and the Rivers Ebbsfleet and Thames. All surface water outfalls into existing water courses will be constructed in accordance with guidelines promoted by Kent County Council (KCC) as the Kent Project Site Lead Local Flood Authority (LLFA) and the Environment Agency. All drainage works required in the foreshore and up to 16 metres inshore from the flood defence line of the River Thames will also be subject to the appropriate flood defence consent from the Environment Agency and the Port of London Authority.

Potable and foul water / utilities

Water Supply

~~17.272~~17.273 Construction works associated with water supply to the development include:

- At the Kent Project Site, wider network reinforcement upgrades including strategic supply source, pipelines and pump stations external to the site boundary (details not yet defined by TW and to be developed in future design stages).

- Construction of diverted 600mm trunk main, plus removal of existing trunk main and distribution mains. The diverted trunk main will be coordinated with other underground infrastructure and be located within an easement. All diversion works proposed will be in accordance with Thames Water design requirements for adoption.

- Water storage tanks, pump stations and distribution pipelines for potable water and irrigation water will be constructed to service the development and will be constructed within the development extents in dedicated compounds or in trenches along access road corridors, under pedestrian routes or landscape areas.

- Supply for construction works is not quantified at this stage. However temporary supply through TW at the Kent Project Site and through ESW at the Essex Project Site will need to be acquired. Reference is made to the Utilities Statement (document reference 7.6) submitted with this DCO application for details of the water supply strategy and engagement with ESW and TW.

Foul Water

~~17.273~~17.274 Construction works associated with foul drainage for the development include:

- Foul drainage within the development areas comprise of pipelines, maintenance holes, lifting stations and pump stations (if required). These will be located in dedicated compounds or in trenches along access road corridors, under pedestrian routes or landscape areas.

- The Kent Project Site requires construction of a new on-site WWTW for the treatment of wastewater. The WWTW and associated effluent outfall works in the Thames River will be designed and constructed in accordance with any design parameters and discharge limits to be advised by the EA and other relevant stakeholders.

- A treated sewage effluent storage, pump station and distribution main from the on-site WWTW to the development will need to be constructed. These will be constructed along the same alignment as the wastewater main that runs to the WWTW. Refer to the Utilities Statement (document reference 7.6) for details.

- The Kent Project Site also includes demolition and removal of the SW decommissioned WWTW and its 375mm influent and 525mm effluent lines, as well as other previously decommissioned mains within the development area. Refer to the Utilities Statement (document reference 7.6) for details.

- The existing and operational SW pump station on Manor Way, located within the Kent Project Site, will be diverted with works which will include demolition and removal of the existing 600mm gravity main, pump station and 400mm rising main. This will be replaced by construction of a new pump station at the west of Manor Way and rising main on a new alignment. The plant will be located in dedicated compounds or in trenches along access road corridors, under pedestrian routes, landscape areas or a dedicated easement. Refer to the Utilities Statement (document reference 7.6) for details.

Disused WWTW

~~17.274~~17.275 Former industrial activities can leave behind a legacy of toxic waste and contaminants, which, if not managed and removed correctly could pose a risk to surrounding environmental receptors.

~~17.275~~17.276 Removal of the old WWTW should be done in compliance with legislative requirements and a precautionary approach to reduce risks to the environment. Assessment of impacts to water bodies assumes a best practice approach to dismantling and demolition of the WWTW to ensure no contaminants are leaked to the ground or surrounding surface water receptors.

Soil hospital

~~17.276~~17.277 A soil treatment centre ("soil hospital") will be an on-site facility designed to provide several treatments techniques necessary to cope with the variable physical and chemical properties of the soils excavated from the earthworks. Such a facility will typically occupy some 2.5ha and likely to be in operation for a minimum of 1 year. The treatment techniques provided are likely to include; screening, sorting, stabilisation, washing, bioremediation and thermal treatments. Topsoil manufacture may also be possible.

~~17.277~~17.278 The efficient use of the facility will balance the throughput of the soil arriving for treatment with the demand for fill, thus minimising the stockpiling of soils at either end of the process.

~~17.278~~17.279 The soil hospital has the introduces an additional contamination risk to the site as soil, much of which will have been used within and around landfill sites will need remediation, and there is a risk of contaminant escape or leaching into the subsurface.

~~17.279~~17.280 All remediation activities on-site will seek appropriate permissions and permits if required and an operational strategy will be followed. A Contaminated Land Management Strategy (Appendix 18.9) (document reference 6.2.18.9) has been produced which presents the outline approach to management and remediation of contaminated land on-site. This assessment considers all mitigation and risk reduction measures set out in there will be employed.

Potential construction effects of the development and their significance

~~17.280~~17.281 The demolition and construction effects will vary, depending on the length of the construction programme and approach to phasing.

~~17.281~~17.282 The risks to the water environment during demolition and construction include:

- Increased water demand from construction site uses;
- Increase in sediment loads caused by site run-off containing elevated suspended sediment levels. This can result from land clearance, excavation, dewatering of excavation, stockpiling, bunding, wheel washing and movement of materials to and from the Project Site;
- The release of hydrocarbons and oils into run-off and on-site drainage system due to

a large number of vehicles accessing the Project Site, leakage from oil/fuel storage tanks and accidental spillages;

- Accidental leaks of hazardous materials, particularly concrete and cement products, which can be contained in uncontrolled wash-down water and surface water run-off;
- Dust and debris caused by poor management of the Project Site;
- Leaks or breakage of temporary sewerage system infiltrating groundwater and/or migrating to surface waters;
- Dewatering of excavations affecting surface water receptors and sewerage infrastructure through change to flows and release of contaminants/sediments;
- Changes to hydrodynamics, sedimentation, erosion and deposition affecting river hydromorphology; and
- Flood risk to users (from excavations and overland flow).

~~17.282~~17.283 These effects can be identified as temporary (construction activities) or permanent (loss of habitat) and risks relating to the water environment as a result of the Proposed Development are discussed in detail below. Mitigation measures identified to reduce any potentially significant effects are presented after the construction and operational impact assessment section.

Increased water demand

Kent Project Site

~~17.283~~17.284 Processes during site preparation, excavation and construction phase of the Proposed Development will require significant volumes of water supply, including water required for an on-site concrete batching plant. In addition, sanitary facilities for site staff, and water supply for wheel washing and washing down of construction areas will also impose additional demand.

~~17.284~~17.285 Discussions are ongoing with Thames Water to finalise the water supply strategy during construction. For construction purposes, water supply may be able to come directly from Thames Water. Greywater recycling options are being appraised and there may be the potential to incorporate these during the construction stage.

~~17.285~~17.286 The magnitude of change on strategic water supplies (high sensitivity) will be medium. This results in a likely **major adverse** temporary/short-term effect on strategic water supplies lasting the duration of the construction phase.

Essex Project Site

~~17.286~~17.287 Processes during site preparation, excavation and construction phase of the development, which may require significant volumes of water supply include sanitary facilities for site staff, and water supply for wheel washing and washing down of construction areas. The Essex Project Site will not require on-site concrete batching – a process which requires large amounts of water. The magnitude of change on strategic water supplies (high sensitivity) will be small. This results in a likely **moderate adverse** temporary/short term effect on strategic water supplies.

Increased sediment loads

~~17.287~~17.288 Site run-off containing elevated suspended sediment levels can result from land clearance, excavation, dewatering of excavation, stockpiling, bunding, wheel washing and movement of materials to and from the Project Sites. Run-off with high sediment loads can have adverse effects on water bodies through increasing turbidity (thus reducing light penetration and reducing plant growth), and by smothering vegetation and bed substrates (thus effecting on animal communities through the destruction of feeding areas, refuges and breeding/spawning areas). Indirect adverse effects can also be associated with suspended sediments that have inorganic or organic contaminants (e.g. heavy metals and pesticides respectively). Sediment can additionally cause issues within runoff channels through clogging and blockages resulting in reduced flow capacity

Kent Project Site

~~17.288~~17.289 Increased sediment loads could affect water bodies through sediment filtering into surface water and discharging directly into the River Thames, or indirectly through the River Ebbsfleet and Swanscombe Channel. Without appropriate construction mitigation measures to reduce and capture sediment runoff, there is potential for a large magnitude of impact on these receptors. When considering the receptor sensitivities (high), the overall significant effect is considered to be **major adverse** for water quality for the River Thames and River Ebbsfleet.

~~17.289~~17.290 Black Duck and Botany Marshes including the Swanscombe Channel could be influenced by increased sediment loads filtering into surface water where sediment can settle in marshland affecting water quality. Without appropriate construction mitigation measures to reduce and capture sediment runoff, there is potential for a large magnitude of impact on these receptors. When considering the receptor sensitivity (high), the overall significant effect is considered to be **major adverse** for water quality in Black Duck and Botany Marshes including Swanscombe Channel in the absence of further mitigation.

Essex Project Site

~~17.290~~17.291 The potential impacts identified above are considered to be equally relevant for the Essex Project Site, albeit on a reduced scale, with the site either draining directly into the River Thames, or indirectly via the East Tilbury Dock Sewer which drains into the River Thames. The magnitude of impact is considered to be large, resulting in a potentially **major**

adverse effect on the River Thames (high sensitivity) and **major adverse** effect on East Tilbury Dock Sewer (high sensitivity) in the absence of mitigation.

Hydrocarbons and oils

~~17.291~~17.292 The release of hydrocarbons and oils into the on-site drainage system is a common form of pollution where there is vehicle traffic. There is a risk such pollution will increase during construction due to trackout as greater numbers of vehicles access the Project Sites. This increase will likely include a significant number of heavy vehicles. Increased vehicle movements result in a greater likelihood of leakage from oil/fuel storage tanks and accidental spillages. Without appropriate protection measures, oils and fuels that are washed from surfaces into the on-site drainage system are likely to discharge to the drains.

~~17.292~~17.293 Hydrocarbons form a film on the surface of the water body, deplete oxygen levels and can be toxic to freshwater fish. Even at very low concentrations the film can negatively affect the visual appearance of the water body. The effect would be temporary, and water quality within the affected water body would improve over time as pollutants disperse and are treated by natural processes.

Kent Project Site

~~17.293~~17.294 Water body receptors including the River Thames and the River Ebbsfleet could be influenced by increased hydrocarbons and oils getting into surface water drainage as stormwater and run-off drain through these channels and into the River Thames. There is potential for a large magnitude of impact on these water bodies. When considering the receptor sensitivity (high), the overall effect is considered to be **major adverse** and temporary for water quality in these water bodies, in the absence of further mitigation.

~~17.294~~17.295 Black Duck and Botany Marshes including the Swanscombe Channel could also influenced by increased hydrocarbons and oils getting into surface water drainage as stormwater and run-off drain into and dissipate through marshland areas. When considering the receptor sensitivity (high), the overall effect is considered to be **major adverse** and temporary for water quality in these water bodies, in the absence of further mitigation.

Essex Project Site

~~17.295~~The effects described for the Kent Project Site are expected to be similar for the Essex Project Site with impacts on the River Thames (high sensitivity) from hydrocarbons and oils considered **major adverse** and temporary, and impacts on East Tilbury Dock Sewer (high sensitivity) considered **major adverse** and temporary in the absence of further mitigation.

17.296

Accidental leaks of hazardous materials

17.297 The use of concrete and cement products on site can present a pollution risk because of the potential for uncontrolled release of wash-down and surface water run-off if these activities are not carried out in designated areas. Wastewater of this nature may enter a water body and adversely affect the combined sewer and aquatic environment. Concrete products are highly alkaline and corrosive; fish can be physically damaged, and their gills blocked, and both vegetation and the bed of the water body can be smothered.

17.298 During demolition and construction there is an elevated risk of potential leaks or accidental spillage of hazardous chemicals infiltrating to groundwater or migrating to surface water bodies. However, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the water body, that a significant risk of acute toxicity will arise in the receiving water body. The magnitude of any change will depend on the scale and nature of any potential incident and thus is difficult to predict.

17.299 For the most part, effects are likely to be temporary. Water quality within the affected water body will improve over time as pollutants are dispersed and diluted.

Kent Project Site

17.300 The River Thames and the River Ebbsfleet, could be influenced by accidental leaks of hazardous materials getting into surface water drainage or escape of contaminants from the disused WWTW and soil remediation processes. In addition, there is likely to be concrete batching on the Kent Project Site which requires particular consideration given the potential impacts of concrete materials. There is potential for a large magnitude of impact on these water bodies. When considering the receptor sensitivity (high), the overall significant effect is considered to be **major adverse** for water quality in these water bodies, in the absence of further mitigation.

17.301 Black Duck and Botany Marshes including the Swanscombe Channel could also be affected by any leaks of hazardous materials or contaminants from demolition and construction operations on site as well as contaminant escape from soil remediation activities. When considering sensitivities of these receptors (high), the overall significant effect is considered to be **major adverse** for water quality in these water bodies, in the absence of further mitigation.

Essex Project Site

~~17.302~~ No concrete batching will be necessary at the Essex Project Site, and there are not the same risks associated with higher-risk infrastructure currently on-site, however the same risks and effects from general leaks and contamination as a result of the construction process are present. There is potentially a large magnitude of impact. Significant effects from accidental leaks of and use of hazardous materials on East Tilbury Dock Sewer (high sensitivity) are considered **major adverse.** Significant effects on the River Thames (high sensitivity) considered **major adverse** in the absence of further mitigation.

~~17.303~~

~~17.304~~17.302

Dust and debris

~~17.305~~17.303 Demolition and construction activities located on the Project Sites have the potential to release dust and debris that may be blown into adjacent water bodies. Increased dust levels in water bodies may reduce the levels of light reaching aquatic plant and animal species. Debris blown into water bodies can decrease the recreational and aesthetic quality of the water body. Effects will however be temporary; water quality within the affected water body will improve over time as dust and debris settle or are trapped by vegetation. Sediment/debris can additionally cause issues within combined sewer networks through clogging/blocking, a reduction in flow capacity and premature operation. Again, affects would be considered temporary.

Kent Project Site

~~17.306~~17.304 Considering the adjacent proximity of the River Thames, River Ebbsfleet and marshes including Black Duck and Botany Marshes (high sensitivities), the magnitude of impact on these is considered to potentially large resulting in a significance effect of **major adverse** in the absence of further mitigation.

~~17.307~~17.305 Other surrounding water bodies could also be affected by windborne dust and debris. Sawyer's Lake and Castle Hill Lake (high sensitivities) could both experience adverse impacts, though the magnitude of change would be considered small given their distance from the Site, resulting in a **moderate adverse** effect significance in the absence of further mitigation.

Essex Project Site

~~17.308~~17.306 The same effects associated with dust and debris and described for the Kent Project Site are possible at the Essex Project Site as a result of construction activities. In the absence of further mitigation, the magnitude of impact on the River Thames and East Tilbury Dock Sewer is considered large given their location, resulting in a **major adverse** effect significance on the River Thames (high sensitivity) and a **major adverse** effect significance on East Tilbury Dock Sewer (high sensitivity). The magnitude of impact on the more distant Pincocks Trough (low sensitivity) is considered to be small resulting in a **moderate adverse** effect significance.

Leak and breakage of the temporary sewerage system

~~17.309~~17.307 Leaks and breakages of sewers from the temporary toilet facilities provided on-site during demolition and construction works may result in crude sewage infiltrating groundwater or being washed into the site drainage system. Sewage contains high levels of nutrients, organic matter, coliforms and suspended solids. These can result in nutrient enrichment and eutrophication, smothering of bottom-dwelling organisms and plants, and significantly reduced oxygen levels. The effect would be temporary as water quality

within the affected water body would improve over time as organic matter is dispersed and treated by natural processes.

Kent Project Site

~~17.310~~17.308 The River Thames and River Ebbsfleet could be influenced by leakage or breakage of the temporary sewerage system, with sewage migrating into these water bodies directly or indirectly through discharge through drainage channels. There is potential for a large magnitude of impact on these water bodies. When considering the receptor sensitivities (high), the overall significant effect is considered to be **major adverse** for water quality in the River Thames and River Ebbsfleet in the absence of further mitigation.

~~17.311~~17.309 Black Duck and Botany Marshes including the Swanscombe Channel are also subject to the same potential impacts. When considering the receptor sensitivities (high), the overall significant effect is considered to be **major adverse** in these marshlands in the absence of further mitigation.

Essex Project Site

~~17.312~~17.310 Effects similar to those described for the Kent Project Site are expected at the Essex Project Site with impacts from leak and breakage of the temporary sewerage systems. The effects on the River Thames (high sensitivity) are assessed as being **major adverse** and those on East Tilbury Dock Sewer (high sensitivity) considered to be **major adverse** in the absence of further mitigation.

Dewatering of excavations

~~17.313~~17.311 The dewatering of excavations, if required, will be discharged to adjacent watercourses under formal agreement with the sewerage undertaker or the EA. Without mitigation dewatering can have significant effects on flow and introduce contaminants into discharge areas. In the case of discharge to sewerage infrastructure, the volume will minimise the flow capacity temporarily.

Kent Project Site

~~17.314~~17.312 Dewatering from the Kent Project Site may discharge in to the River Thames under formal agreement with the EA. This will stipulate the treatment requirements for discharge to the watercourse. Without treatment there could be impacts on water quality. The magnitude of change is considered moderate adverse and the effect significance on the River Thames and River Ebbsfleet (high sensitivity) is considered **major adverse**.

Essex Project Site

~~17.315~~17.313 On the Essex Project Site, dewatering of excavations could be discharged to the adjacent River or sewerage channel – East Tilbury Dock Sewer. If contaminants in the water makes this problematic, water could be discharged into sewerage infrastructure and

treated at Tilbury Water Recycling Centre. Direct discharge to East Tilbury Dock Sewer could, if flows and potential contaminants are unmitigated, cause large adverse magnitude of change, resulting in a **major adverse** impact to East Tilbury Dock Sewer (high sensitivity). If discharged to the combined sewer network, the change to the capacity, in the event that flows are not managed appropriately, is considered to be small. The effect significance on the sewerage network (moderate sensitivity) in this scenario is therefore potentially **moderate adverse** if flows are not managed correctly.

Changes to River Thames hydrodynamic and sedimentation regime

~~17.316~~17.314 Changes to marine infrastructure could have knock-on effects on the hydrodynamic regime of the River Thames, including direct impacts on flow speed and direction within the water column as well as changes to areas and speed of sedimentation and erosion. The Hydrodynamic and Sedimentation Assessment (Appendix 17.4) (document reference 6.2.17.4) provides full modelled results and detail on all scenarios tested.

Kent Project Site

~~17.317~~17.315 ~~None~~ Neither of the proposed marine development options (A and B) at the Kent Project Site have any effect beyond the immediate vicinity of the marine infrastructure. ~~Option C is thought to have the largest effect on~~, and therefore ~~the hydrodynamics with the greatest footprint of change, but even still~~ the magnitude of change of hydrodynamic flow on the river geomorphology is considered negligible. Due to the proposed levels for the habitat creation areas there is not much tidal volume being exchanged so the magnitude of change of the flow passing in and out is **negligible**.

~~17.318~~17.316 In terms of sedimentation, erosion and deposition, very limited impacts are predicted for ~~any~~ either of the ~~three~~ two marine infrastructure options. A coarsening of the bed sediment under the passenger ferry pontoon at the Kent Project Site may occur depending on the nature of the existing bed in this area. No effects on the erosion or deposition patterns are seen on the intertidal areas near the Kent Project Site. Although in the medium term some effect of the flow in and out of the habitat creation areas is likely, creating small drainage channels. ~~The dredging associated with Option C could have an annual infill rate of approximately 29,700m^3 per year, which would require periodic dredging campaigns. The rate is a conservative estimate as the rate is likely to reduce as the dredged area fills and considering the effects of the operating vessels.~~ No discernible effect is seen on suspended sediment concentration.

~~17.319~~17.317 Overall, the magnitude of impact is considered negligible, and the effect significance on River Thames geomorphology (high sensitivity) as a result of changes to hydrodynamic and sedimentation regime is considered **negligible**.

Essex Project Site

~~17.320~~17.318 At the Essex Project Site, the proposed marine development impedes the

hydrodynamic flow and reduces currents to either side of the structure. The magnitude of effect is considered negligible.

~~17.321~~17.319 In terms of sedimentation, erosion and deposition, very limited effects are predicted with these limited effects only taking place in the immediate area of the proposed marine infrastructure and the exiting Landing Stage. No changes to the pattern of erosion and deposition are predicted on the intertidal area to the north of the proposed marine infrastructure.

~~17.322~~17.320 Overall, magnitude of impact is considered negligible, and the effect significance on River Thames geomorphology (high sensitivity) as a result of changes to hydrodynamic and sedimentation regime is considered **negligible**.

Flood risk to demolition/construction workers and construction plant

Kent Project Site

~~17.323~~17.321 Measures should be taken to protect construction workers from flooding at the Kent Project Site. This includes flooding from residual tidal and fluvial flood sources in addition to water ingress from any excavations on-site. Construction workers are considered a high sensitivity receptor, and the magnitude of potential impact is likely to be small. The effect significance on construction workers and plant is considered to be **moderate adverse** without further mitigation.

Essex Project Site

~~17.324~~17.322 Potential impacts are considered equally as relevant at the Essex Project site, and measures should also be taken to protect construction workers from all forms of flooding. Construction workers are considered a high sensitivity receptor, and the magnitude of potential impact is likely to be small. The effect significance on construction workers and plant is considered to be **moderate adverse** without further mitigation.

Operational effects

Relevant aspects of the scheme and designed-in mitigation

Potable water demand

~~17.325~~17.323 A summary of the proposed potable water supply arrangements within the order limits is provided here. For full details, reference should be made to the Utilities Statement (document reference 7.6) which supports the DCO application.

~~17.326~~17.324 A key aim of the water supply strategy across the entire project is to provide sustainable and reliable servicing to the development such that it will meet variations in demands, while reducing the impact on external networks. The supply strategy has been

developed with the following objectives:

- Reducing potable water demands as far as reasonably practical;
- Maximising opportunities for use of recycled and other non-potable water sources;
- Providing a reliable supply to site throughout all stages of the development; and
- Location and design of water infrastructure to minimise any impact on the user experience (visual, odour etc).

~~17.327~~17.325 Incorporation of water demand management practices will be promoted for the Proposed Development and consideration given to all water-use activities. A minimum target reduction of 25% from business as usual (BAU) standard demands has been targeted as required by Gravesham Borough Council planning policy.

Kent Project Site

~~17.328~~17.326 Table 17.17 provides a summary of the long-term demand estimate for the Kent Project Site. It includes the target 25% reduction from BAU.

Table 17.17: Kent Project Site water demand estimate

Development Area	Demand	Demand (m^3/day)
Gate Areas	Potable water	2,084
	Irrigation water	860
Balance of Site (hotels, staff, other)	Potable water	2,236
	Irrigation water	218
Contingency (20%)		1,079
Average Day Total		**6,477**
Average Day Total + Non-Revenue Water		**6,801**
Peak Day Total		**13,278**

~~17.329~~17.327 Kent is a water stressed area, with the Proposed Development being located at the downstream end of the Thames Water supply area. Thames Water has identified that network upgrades and additional supply will be required to provide supply to the development. Therefore, the water supply strategy has been developed to allow greatest flexibility in operations within the site whilst also mitigating impact to the external networks. The intent will be to reduce the extent of external network upgrades and any impact on the wider community.

~~17.330~~17.328 The following provides a summary of the proposed water supply strategy for the Kent Project Site (these are in addition to the water demand management measures described above):

- Peak hourly / instantaneous demands from hotel and commercial areas (including the Gates) to be managed through on-site storage;
- On-site potable water storage to provide potable demands plus emergency firefighting reserve;
- Irrigation supply to be considered separately to potable water from non-potable sources;
- Management of refilling of storage tanks to mitigate amplified impacts on the Thames Water networks - to be agreed with Thames Water;
- Firefighting systems supplied by the internal potable water networks, with hydrants provided along access roads as required.

~~17.331~~17.329 Storage will be investigated within the site so as to manage peak instantaneous demands on the Thames Water networks. Allocation for a central water storage space and a pump station has been made in the site planning. This infrastructure is located at the Bamber Pit utility compound, to the south of the development. Any constraints on the time period or filling rate for the storage tanks will be agreed with Thames Water to alleviate pressures on external networks. A direct drinking water supply will be provided to residential buildings, as required under UK regulations.

~~17.332~~17.330 Land allocation for a separate irrigation water storage and pump station is provided at the Sports Ground utility compound. Discussions are ongoing with Thames Water and consider the worst-case scenario, with all irrigation water supplied by the potable network. However, options for alternative long-term supply from the following sources will be considered at future design stages, including:

- Rainwater harvesting on-site through integration with the surface water drainage strategy (see Appendix 17.2 Surface Water Drainage Strategy) (document reference 6.2.17.2) or at building-level tanks to collect roof water;
- Greywater recycling on-site; and
- Treated sewage effluent recycled from the on-site WWTW.

~~17.333~~17.331 Water demand estimation for the Kent Project Site at this stage is based on the current status of the Project and will be developed further as future design stages progress. The assumptions and build-up of the water demand estimate have been reviewed and discussed with Thames Water representatives. Discussions with Thames Water are ongoing and will continue throughout the development of project and the future design stages. The demand figure for the Kent Project Site of 13,278 m^3/day has been established in discussions with Thames Water and used for assessment of strategic supply as the current estimate of demands. This figure will be revised as further

information becomes available.

~~17.334~~17.332 It has been agreed with Thames Water that options to reduce potable water demands are to be further pursued beyond the submission of the DCO application. Opportunities for using non-potable water sources are to be incorporated where possible. As a minimum, it is expected that, in the long-term supply strategy, a significant proportion of irrigation water will be supplied by a combination of either greywater, treated sewage effluent (recycled water) or rainwater harvesting.

Essex Project Site

~~17.335~~17.333 Table 17.18 provides a summary of the long-term demand estimate for the Essex Project Site, including the target 25% reduction from BAU.

Table 17.18: Essex Project Site water demand estimate

Development Area	Demand	Demand (m^3/day)
Tilbury Docks	Potable water	9
Contingency 20%		2
Average Day Total		10
Average Day Total + Non-Revenue Water		**11**
Peak Day Total		**21**

~~17.336~~17.334 Essex and Suffolk Water has advised that there is currently capacity to service the Essex Project Site with 7l/s flow rate. A connection point into the existing 355mm main on Ferry Road, with a supply pressure between 17-20m, has been agreed with Essex and Suffolk Water.

~~17.337~~17.335 Water will be supplied directly from the network to each point of use within the Essex Project Site, with no additional storage proposed to be provided on site. The potable water network will supply for buildings and firefighting use. Detailed network assessment in future design stages will determine if localised pressure boosting is required within the Site.

~~17.338~~17.336 Tilbury Docks in its current state is developed and new demands as a result of the London Resort project are not anticipated to cause a significant increase to servicing requirements.

Foul water drainage strategy

~~17.339~~17.337 A summary of the proposed foul water drainage arrangements located within the order limits is provided here. For full details, reference should be made to the Utilities Statement (document reference 7.6) which supports the DCO application.

~~17.340~~17.338 A key aim of the wastewater strategy will be to provide reliable servicing to the development that will meet variations in wastewater flows through each phase of the development, while mitigating any nuisance impact on surrounding developments as far as reasonably practical. The strategy was developed with the following objectives:

- Separate wastewater and surface water drainage networks;
- Collect and treat all wastewater from the development;
- Maintain existing wastewater servicing for surrounding development; and
- Provide opportunity for the recycling and reuse of wastewater, where feasible.

Kent Project Site

~~17.341~~17.339 The nearest WWTW to the Kent Project Site is the Northfleet WWTW to the south-east of the site and is operated by SW. The option to provide a new connection into the Northfleet WWTW was discussed with SW. However, it was confirmed there is currently no spare capacity within the catchment. SW also noted that the proposed development is not within their 2020-2025 Business Plan, which addresses agreed infrastructure improvements across the service area.

~~17.342~~17.340 The Development team will continue to liaise with SW as the project progresses through future stages and to pursue future options to service the site or under the next 2025-2030 Business Plan. SW advised that the earliest an upgrade could be delivered is March 2030.

~~17.343~~17.341 An on-site WWTW is being constructed as part of the adjacent Ebbsfleet project. Again, it was confirmed to not have capacity for the Proposed Development.

~~17.344~~17.342 ~~Unless SW is able to advance their infrastructure improvements, a~~A~~n~~ O~~o~~n-site wastewater treatment is proposed for the Kent Project Site in lieu of alternate options to connect into existing infrastructure. Local treatment of wastewater allows the wastewater systems to be contained within the Project Site and for the Project to ~~deal with~~manage its own waste. A by-product of the treatment process is treated effluent, which, will be ~~if~~ treated to the appropriate quality and~~, may also be~~ re-used for non-potable use, including irrigation. ~~The potential for treating the effluent to a standard suitable for reuse will be further investigated as the detailed design stages progress.~~ Where effluent is not reused, an outfall into the Thames River will be required and it will be treated to an appropriate standard for this situation.

17.343 A site for the WWTW has been promoted at the north-east of the Kent Project Site, adjacent to the existing leachate treatment plant. This location is situated at a distance away from the Proposed Development and from existing development. Modern WWTW are designed to mitigate odour issues, however locating the WWTW in this location will

further reduce any potential risk.

~~17.345~~17.344 It is proposed that any unused treated effluent from the WWTW will be discharged into the River Thames either via a discharge pipe from the shore into the river, or via a discharge channel – both would be at a point to the north east of the works. A parcel of land (block 14c) within the resort has been allocated for the WWTW and the boundary of this block extends approximately 130m into the River Thames. It has been proposed that the discharge from the WWTW, whatever form it takes, will take place within the boundary of this block.

~~17.346 The treated effluent outfall pipe is proposed to be direct from the WWTW, east towards the Thames River. PLA charts of the Thames River adjacent the WWTW site indicates that the riverbed level drops sufficiently such that a submerged outfall pipe can be designed, if this is required by the EA.~~

~~17.347~~17.345 There will be further requirements for any outfall of treated effluent into the River Thames. There is potential for pollution and scour, if not managed appropriately and in accordance with design constraints to be defined by the EA.

~~17.348~~17.346 Design parameters and constraints for the on-site WWTW and discharge of treated effluent into the Thames River or for reuse, require co-ordination and agreement with the EA and PLA, among other stakeholders. It is anticipated that EA approval ~~is~~ will be progressed via the Environmental Permitting process.

Essex Project Site

~~17.349~~17.347 Tilbury Docks is developed and new demands as a result of the Proposed Development are not anticipated to cause a significant increase to servicing requirements.

~~17.350~~17.348 As agreed with AW, a direct connection into the existing wastewater networks is proposed and treatment provided Tilbury Water Recycling Centre. Three options for connection points were provided by AW. It is proposed to connect into the existing network at manhole no. 3501, to the west of the Essex Project Site.

Surface water drainage strategy

~~17.351~~17.349 A summary of the proposed surface water drainage strategy is provided here. For full details, reference should be made to the Surface Water Drainage Strategy (Appendix 17.2) (document reference 6.2.17.2).

~~17.352~~17.350 The proposed surface water drainage design has been prepared in accordance with the drainage hierarchy identified in the NPPF Planning Practice Guidance, the guidance in the C753 SuDS Manual (CIRIA, 2015), the guidance in the KCC Drainage and Planning Policy (KCC, December 2019), the Sustainable Drainage Systems – Design Guide (ECC, 2016) and advice provided during consultations with the key consultees.

Kent Project Site (Main Resort)

~~17.353~~17.351 The strategy for the surface water drainage will meet the following criteria:

- Discharge to the River Thames does not have to be controlled or attenuated to match or reduce the existing run off rates due to the tidal nature of the River Thames;
- The 1 in 1-year rainfall event is to be contained within the stormwater network pipes on site and not surcharge the network;
- The 1 in 30-year rainfall event with 40% allowance for climate change is to be contained within the stormwater network allowing for surcharging of the network, but with no flooding on the surface;
- The 1 in 100-year rainfall event with 40% allowance for climate change is designed to flood the surface of the Kent Project Site (Main Resort) but will have no impact to buildings or off-site.

~~17.354~~17.352 Surface water storage will be designed to ensure flood risk to the Kent Project Site (Main Resort) is safely managed during periods of high tide, when the surface water drainage network is not able to drain via gravity into the River Thames. Storage on-site will be provided for the below tide-locked scenarios:

- a 1 in 1-year rainfall event coinciding with the 1 in 200 year (2090 Higher Central scenario) tidal event; or
- a 1 in 100-year (with allowance for climate change) rainfall event coinciding with the Mean High Water Spring tidal level.

~~17.355~~17.353 The drainage strategy will aim to ensure that the Botany Marsh East and Black Duck Marsh are not adversely affected and where possible improved. It is understood that the marsh habitats have changed over the years, resulting in reduced freshwater inflows and increased salinity. An extended programme of ecological surveys and water quality sampling are currently being undertaken to assess the existing condition and inform the baseline condition during design development.

~~17.356~~17.354 A surface water gravity network (pipes or swales where possible) is proposed to collect rainfall run-off from the buildings and impermeable surfaces and convey to dedicated areas within the two existing marsh areas (Botany Marsh and Black Duck Marsh) via outfalls with non-return valves where required. A new constructed wetland is proposed at the north of Gate One. Surface water runoff from large parts of Gate One will be attenuated at the new constructed wetland, prior to discharge to River Thames.

~~17.357~~17.355 The two marshes and new constructed wetland will act as attenuation areas of

surface water during tide-locked conditions. New outfalls from the marsh areas and wetland to the River Thames will discharge surface water runoff unrestricted when the tide is low. The Surface Water Drainage Strategy (Appendix 17.2) demonstrates that the surface water volumes from the development can be safely attenuated within the marsh areas and wetland during tide-locked conditions and therefore the development does not increase flooding to the Kent Project Site (Main Resort) or other sites due to the increase in impermeable areas.

~~17.358~~17.356 Ecological monitoring of the wetlands pre- and post- development will be undertaken to ensure the water levels within the marsh areas support the intended habitats. Discharge outfalls from the marshes to the Thames will include manual flow/level controls to adjust water levels within the marshes as required.

~~17.359~~17.357 The proposed constructed wetland at the north of Gate One has been sized for tide-locked conditions. A new 280m culvert is proposed, extending from the constructed wetland to the River Thames, northwest of the Principal Development to allow discharge of the flows from Gate One and the wetland.

~~17.360~~17.358 A new 250m long ecological channel is proposed between the wetland and the River Thames (Bay area) on a south to north direction. The purpose of the channel is to provide additional opportunities for habitat and amenity, as well as act as an overflow from the constructed wetland to the Bay.

~~17.361~~17.359 The Related Housing (staff accommodation) and infrastructure compounds are located on areas with good infiltration potential and low levels of contamination. These areas are proposed to drain via infiltration.

~~17.362~~17.360 Pumping will be avoided and restricted to specific areas where the existing ground levels are very low around the HS1 tunnel.

~~17.363~~17.361 Flows to the existing Swanscombe Channel (Main River) are anticipated to be reduced significantly following proposed diversion of flows from Eastern Quarry. The Channel is proposed to be diverted to Black Duck Marsh, along Pilgrims way, and will collect flows from adjacent catchments as well as any flows from outside the site.

~~17.364~~17.362 Sustainable Drainage Systems (SuDS) will be incorporated across the Kent Project Site (main Resort) to manage surface water flows and minimise the risk of pollution to the water environment. SuDS are used to mimic more natural processes to convey surface water away from a development.

~~17.365~~17.363 Given the concerns relating to the contaminated ground conditions, infiltration systems will be avoided in areas contaminated land may be present, as these systems could mobilise pollutants. Filtration systems, that treat water before discharge are proposed within the Kent Project Site.

~~17.366~~17.364 The surface water strategy will also include opportunities for biodiversity

enhancements such as the improved design and management of wetland areas and increase in inter-tidal habitats, as well as the opportunity to combine strategies with water use within the Proposed Development to ensure the Project Site remains resilient to future changes in climate variability and change.

~~17.367~~17.365 In order to prevent the mobilisation of existing contaminants to groundwater, infiltration measures will not be incorporated in the design where contaminated land is recorded. Open drainage systems such as swales will be appropriately lined. Surface water runoff from the Proposed Development will be treated before discharge to the River Thames the new constructed wetland area will be designed to treat surface water runoff before discharge to the river.

Kent Project Site - Access Road

~~17.368~~17.366 The proposed drainage system will be designed for the following criteria:

- The 1 in 2-year rainfall event is to be contained within the stormwater network pipes on site and not surcharge the network;
- The 1 in 30-year rainfall event with 40% allowance for climate change is to be contained within the stormwater network allowing for surcharging of the network, but with no flooding on the surface;

~~17.369~~17.367 Proposed run-off rates not to exceed existing for the respective 1 in 2 year and 1 in 100 year events plus 40% climate change.

~~17.370~~17.368 SuDS have been incorporated within the drainage network, to provide additional benefits in terms of habitat creation, biodiversity and water quality (ponds and oil interceptors).

~~17.371~~17.369 The drainage strategy for the Access Road Site is to discharge by gravity through a network of attenuation ponds to the River Ebbsfleet at Greenfield runoff rates. Infiltration to the ground will be used where proven possible, pending further site investigation.

~~17.372~~17.370 Some sections of highway to the south will include standalone highway soakaways. A pumping station and associated storage will be required to drain the northern part of the proposed access road, where gravity drainage is unfeasible.

~~17.373~~17.371 Where existing ponds are impacted by the proposed access road, they are to be relocated on a like-for-like basis, to ensure no net loss of attenuation capacity and biodiversity.

~~17.374~~17.372 The stormwater draining from the Kent Project Site (Access Road) must also be assessed and improved with regard to water quality, biodiversity and amenity. In accordance with CIRIA SuDS Manual (C753) Simple Index Approach, surface water from the Kent Project Site (Access Road) should be treated based on the pollution hazard level

associated with the land use. Highway drainage systems will require the use of bypass separators (or similar) to be located at strategic locations prior to flows infiltrating to the ground and/or discharging to Ebbsfleet River. It is proposed that the ponds are landscaped to include shallow vegetation such as reedbeds (wetland) to treat potential pollution from the highway. It is also proposed that shallow highway swales combined with tanked filter drains are incorporated into the drainage system where possible, to provide further treatment stages. The overflow connections interlinking the ponds will include pollution control valves to ensure that extreme pollution incidents can be contained with minimal risk to the wider drainage network.

Essex Project Site

~~17.375~~17.373 The strategy for the surface water drainage will meet the following criteria:

- Discharge to the River Thames does not have to be controlled or attenuated to match or reduce the existing run off rates due to the tidal nature of the River Thames;
- The 1 in 1-year rainfall event is to be contained within the stormwater network pipes on site and not surcharge the network;
- The 1 in 30-year rainfall event with 40% allowance for climate change is to be contained within the stormwater network allowing for surcharging of the network, but with no flooding on the surface; and
- The 1 in 100-year rainfall event with 40% allowance for climate change is designed to flood the surface of the Project Site but will have no impact to buildings or off-site.

~~17.376~~17.374 Surface water storage for the Proposed Development will be designed to mitigate the Essex Project Site from surface water flooding during periods of high tide, when the surface water drainage network is not able to drain via gravity into the River Thames. Storage on-site will be provided for this tide lock scenario. The tide locked scenario will be designed for the combined probability of either:

- a 1 in 5-year rainfall event (with allowance for climate change) coinciding with the 1 in 200-year (2090 Higher Central allowance) tidal event; or
- a 1 in 100-year (with allowance for climate change) rainfall event coinciding with the 1 in 20-year (2090 HA allowance) tidal event.

~~17.377~~17.375 It is proposed that the drainage pipes serving the area of the proposed multi-storey car park (MSCP), and connecting to East Tilbury Dock Sewer, are made redundant to reduce the existing fluvial flood issues at Tilbury.

~~17.378~~17.376 A new pipe will be constructed to convey flows from the MSCP building and the visitor plaza to the River Thames. If the existing Port of Tilbury outfall is considered

appropriate for use, the new pipe will be connected to it. Alternatively, a new outfall will be required.

~~17.379~~17.377 Green/brown roofs at the MSCP and permeable pavements at the visitor plaza are proposed for pollution control.

~~17.380~~17.378 Underground attenuation will be provided to accommodate surface water runoff during the tide-locked scenarios above. Two attenuation areas are currently proposed next to the MSCP building and underneath the permeable pavement in the visitor plaza.

~~17.381~~17.379 The stormwater draining from the Essex Project Site must also be assessed and improved upon in regard to water quality. In accordance with CIRIA SuDS Manual (C753) Simple Index Approach, surface water from the Essex Project Site should be treated based on the pollution hazard level associated with the land use. This includes permeable pavements and mechanical separators – bypass separators or full retention separators.

On-site flood risk strategy

~~17.382~~17.380 A detailed summary of the flood risk strategy is provided in the FRA (Appendix 17.1) (document reference 6.2.17.1). A summary is provided in this section of the document.

Kent Project Site

~~17.383~~17.381 It is anticipated that London Resort Gate 1 will open in 2024, whilst Gate 2 is planned to open in 2029. There is no confirmed decommission date for the Resort. The assessment has been undertaken on the basis of a 60-year development life (to 2090). However, considerations have been made for a 100-year development life (2125) and the flood risk impact and flood mitigation measures that may be required to keep the development safe in that timeframe.

~~17.384~~17.382 At the Kent Project Site, flood risk mitigation measures have been promoted through the masterplan design to ensure the following standards of protection:

- The Kent Project Site – 1 in 1000 year tidal event to 2070.
- The Kent Project Site Less Vulnerable development – 1 in 200 year higher central climate projections to 2090.
- The Kent Project Site More Vulnerable development – 1 in 200 year upper end climate change projections to 2125.

~~17.385~~17.383 For the purpose of the FRA, More Vulnerable development uses are considered as sleeping accommodation, safe refuge areas, highly vulnerable (telecommunications installations) and essential infrastructure (required to function and operate during a

flood). Less Vulnerable development uses are considered as water compatible and other essential infrastructure (not required to function and operate during a flood).

~~17.386~~17.384 In order to achieve these standards, the following has been proposed relating to the formal flood defences on the west of the Kent Project Site (see Figure 17.3~~13~~):

- At Black Duck Marsh: increase the formal flood defence crest level along the existing alignment.
- At the Jetty: replace the existing flood walls and flood gates with a flood embankment along a new alignment to the landward side of the Jetty Proposed Development.

~~17.387~~17.385 During the initial phase of operation the embankment defence crest levels will be set to a minimum of 7.00mAOD, which is the level required by the year 2070 under the EA TE2100 Plan.

~~17.388~~17.386 After 2050, when the EA confirm their Thames Barrier Improvement works option, a review of the standard of protection for the site and the levels required will be made.

~~17.389~~17.387 If the review indicates that additional standard of protection is required, there will be a commitment to ensure that this is in place by 2070.

~~17.390~~17.388 The current worst-case scenario for the Project Site is in the event of the development of a new Thames Barrier at Long Reach.

~~17.391~~17.389 Allowances have been made for the future raising of the formal flood defence crest levels to 8.00m AOD, which is the level required for the period 2070 to 2170 by the EA TE2100 Plan for Option 3.2, a new barrier at Long Reach.

~~17.392~~17.390 To the east of the Kent Project Site:

- A new secondary flood defence embankment along the east of the Proposed Development (the west of Botany Marsh).
- The defence crest level of the embankment will be set to 3.00m AOD, which is the level required by the year 2090 to ensure the site is protected from the 200 year and 1000-year overtopping flood levels.

~~17.393~~17.391 There is a residual risk to flooding due to a breach in the tidal flood defences. During such events, the following standards of protection will be provided:

- Kent Project Site Less Vulnerable development – at risk from a breach event 1 in 200-year higher central climate change projection 2090.
- Kent Project site More Vulnerable development – 1 in 200-year upper end climate change projections to 2125.

~~17.394~~17.392 In order to achieve these standards of protection the following has been proposed for the Kent Project Site:

- The finished floor levels of sleeping accommodation, safe refuge points and invacuation routes of *More Vulnerable* developments, as well as the podium levels of *Critical Infrastructure* required to be operational during a flood event, is set above whichever is higher of the following flood events:
    - The 1 in 200-year 2125 upper end maximum water level plus 300mm freeboard; or,
    - The 1 in 1000-year 2125 higher central maximum water level.
- Less vulnerable developments are made flood resilient up to whichever has a higher maximum water level of the following flood events:
    - The 1 in 200-year 2090 upper end maximum water level plus 300mm freeboard; or,
    - The 1 in 1000-year 2090 higher central maximum water level.
- At the Kent Project Site (Access Road) compensatory flood storage will be provided for 0.13 ha of floodplain that will be lost as a result of the Proposed Development in order that the flood risk from the River Ebbsfleet to surrounding areas is not increased. The levels of the Access Road will be set above the 1 in 100 year plus 70% climate change, for the 2125 future epoch using the upper end climate change projections plus 300 mm freeboard.

Essex Project Site

- At the Essex Project Site Less Vulnerable development uses are being proposed and will be made flood resilient up to whichever has a higher maximum water level of the following flood events:
    - The 1 in 200-year 2090 upper end maximum water level plus 300mm freeboard; or,
    - The 1 in 1000-year 2090 higher central maximum water level.
- It is not proposed to alter the existing formal flood defences that are included within the Order Limits at the Essex Project Site. The design team will work closely with the EA as they develop their proposals for new flood defences to ensure that an integrated approach to an effective solution can be achieved.

~~17.395~~17.393 A flood evacuation and management plan will be established for both the Kent and Essex Project Sites.

~~17.396~~17.394 The H++ model results have been used as a sensitivity check to understand the

impact of flooding on the Kent and Essex Sites using the most conservative climate change projection.

Marine infrastructure and river use strategy

~~17.397~~17.395 The permanent operation of the project will be supported by marine infrastructure. As mentioned earlier in the chapter several options are being considered at this stage. The possible operations are summarised below, and further detail can be found within the Marine Operations Concept Plan (Ref).:

Kent Project Site

- Ferry pontoon – this will be used to transfer visitors and staff based north of the River Thames from the Tilbury passenger terminal to the Resort, as well as transporting guests arriving from upstream;

- Bell Wharf – this will be used to handle outgoing waste via barges to off-site waste handling facilities. It will also be used for incoming bulk supply requirements if needed. Levelling of ~~An additional option being considered is to deepen~~ the riverbed adjacent to Bell Wharf is proposed to enable creation of a NAABSA (Not Always Afloat But Safely Aground) facility ~~greater accessibility and~~to reduce the impact of tidal restrictions;

- ~~Roll-on/roll-off ferry pontoon~~Barge offloading facility – ~~this is an option under consideration to~~this will provide the flexibility to use the Port of Tilbury to support the day-to-day servicing of the Resort, ferrying goods ~~via a roll-on/roll-off ferry~~ from storage in Essex.

- Refurbishment of White's Jetty – this is an alternative being considered to provide flexibility and would be used to support day-to-day servicing of the Resort.

Essex Project Site

~~17.398~~17.396 The extension to the Tilbury Landing Stage will support the provision of Thames Clipper river boat services from central London to London Resort, as well as cross river services transporting passengers between the Essex and Kent project sites.

Potential operational effects of the development and their significance

~~17.399~~17.397 This section considers the potential effects that the Proposed Development will have on the water environment once operational.

~~17.400~~17.398 The effects of the Proposed Development on the water environment during operation include:

- Pollutants contained within surface water run-off contaminating water bodies through overflows/leaks to the sewer system/mobilising contaminants to groundwater;
- Pollutants released to the River Thames through increased use of river vessels to and from the Project Site;
- On-site and off-site flood risk;
- Effect on the marine environment from frequent river movement between the Essex and Kent Project Sites.
- Water services infrastructure may not be able to maintain the increased water demand or place additional strain on availability of water supply in surrounding areas;
- Sewerage infrastructure capacity (network and WWTW) unable to receive foul discharges to the network;
- Alterations to coastal processes within the River Thames; and
- Scour and accretion impacts on the riverbed from surface water discharge and discharge from the proposed WWTW.

~~17.401~~17.399 Specific effects related to groundwater contamination are addressed in detail in Chapter 18 Soils, hydrogeology and ground conditions (document reference 6.1.18).

~~17.402~~17.400 Where impacts are found to be potentially significant, mitigation measures have been identified and are presented in the subsequent section.

Pollutants contained in surface water

~~17.403~~17.401 Pollutants such as silts and hydrocarbons resulting from activities on site such as vehicle storage, vehicle-washing and oil/fuels leaks could discharge to surface water drainage channels. This can potentially increase surface water turbidity, deplete oxygen levels and be toxic to the aquatic environment to water receptors where contaminants are carried.

Kent Project Site

~~17.404~~17.402 The magnitude of change will depend on the activities present and their occurrence. The effect is considered permanent, although certain activities such as accidental spillages would be temporary. Surface water will be collected and drained into either the River Thames or River Ebbsfleet depending on which part of the site it is

collected, with some catchment water draining naturally into the diverted Swanscombe Channel. It is envisaged that the magnitude of change of operational effects on all water bodies will be small beneficial due to the commitments that are made in the Drainage Strategy (Appendix 17.2) and summarised in the 'Surface water drainage strategy' section above, for water quality treatment prior to discharge. Given the poor quality of surface water on site at the moment, partly due to the current leachate management facilities which will be replaced, the overall significant effect is considered **minor beneficial** for the River Ebbsfleet and River Thames (high sensitivities) as well as Black Duck and Botany Marshes including the Swanscombe Channel (high sensitivities).

Essex Project Site

~~17.405~~17.403 As with the Kent Project Site, the magnitude of change will depend on the activities present, but it is envisaged that the magnitude of change of operational effects on all water bodies will be small as a result of the commitments that are made in the Drainage Strategy for water quality treatment prior to discharge. Surface water will be collected and discharged into the River Thames (high sensitivity). The overall significant effect is envisaged to be **negligible adverse** for the River Thames.

Pollutants from river vessels

~~17.406~~17.404 The operational development will increase the use of river vessels at this stage of the River, both through shuttle services between the Essex Project Site and the Kent Project Site, as well as river taxi and shuttle services from London, and refuelling at the Essex Project Site. Discussions with Thames Clippers indicated that a potential service from London Waterloo and Greenwich to the resort could be viable. Boats have the potential to release pollutants – in particular hydrocarbons – into the river through their operation, as well as potential accidental leaks and spillages.

Kent Project Site

~~17.407~~17.405 If unmitigated, the magnitude of change of pollutants from the increased use of boats could be medium adverse. Considering the sensitivity of the River Thames (high), this would result in a potentially **major adverse** impact, without measures in place to mitigate and minimise the release of pollutants.

Essex Project Site

~~17.408~~17.406 As with the Kent Project Site, the magnitude of change of pollutants from the increased use of boats could be medium adverse. Considering the sensitivity of the River Thames (high), this would result in a potentially **major adverse** impact, without measures in place to mitigate and minimise the release of pollutants.

Changes to flood risk

Kent Project Site

~~17.409~~17.407 The raising of the embankment defence crest levels to a minimum of 7.00mAOD, and therefore out of the flood plain, has mitigated the primary flood risk from tidal influences. Looking further ahead at the lifespan of the project, additional flood defence options will be considered following review and decisions on the Thames Barrier Improvement Works option. With the commitments made in the FRA (document reference 6.2.17.1), flood risk on site is expected to be reduced from baseline conditions, however a more sensitive site use is being introduced. Given the balance between flood risk improvements and more sensitive receptors on-site, the magnitude of change is considered to be negligible and effect significance considered to be **negligible** to site users (high sensitivity).

Essex Project Site

~~17.410~~17.408 The Proposed Development will introduce new use categories on site, however as with the current uses on site, these will be low vulnerability category uses. The impact of the proposed buildings means that there are localised increases and decreases in flood level. Overall, the magnitude of change is considered negligible and the effect significance also considered to be **negligible**.

Off-site

~~17.411~~17.409 Run-off from the Proposed Development will be discharged directly to the River Thames, or to the River Ebbsfleet / diverted Swanscombe Channel which discharge to the River Thames. Discharge will be unrestricted as agreed with Local Lead Flood Authorities.

~~17.412~~17.410 Modelling of the proposals indicate that the Proposed Development on both sites does not significantly increase the flood risk to surrounding users during the extreme fluvial or tidal events. The Proposed Development does not increase flood risk elsewhere, including residential areas to the west of Swanscombe Peninsula and commercial areas east of the peninsula towards Northfleet. The magnitude of change and effect significance to flood risk off-site is therefore considered to be **negligible** at the Kent Project Site.

~~17.413~~17.411 At the Essex Project Site, to ensure that the Proposed Development does not increase the flood risk to sites outside the Order Limits, the multi-storey car park will be designed so that the ground level of the structure includes wide openings allowing floodwater to continue to flow into the space that it currently would. The ground floor construction material will be similar to that as existing, which would reduce any displacement of floodwater. At worst, a small adverse magnitude of change is shown through the modelling, resulting in a **minor adverse** flood risk to off-site receptors.

Water demand

Kent Project Site

~~17.414~~17.412 The peak day demand estimate is 13,278 m^3/day prior to the application of demand management measures for all water demands (potable and non-potable). This is a significant change when compared to baseline conditions which comparatively have an extremely low demand, comprising solely of some industrial plots served by distribution mains. The magnitude of impact is considered to be high and the effect significance on water services supply (high sensitivity) is considered to be **major adverse** in the absence of further mitigation measures.

~~17.415~~17.413 The site will incorporate potable water storage options to service some sources of water demand once operational. TW have identified that additional strategic supply is required to service the Kent Project Site. Opportunities for alternative water sources (greywater, recycled water, rainwater etc) will continue to be investigated in liaison with TW at future design stages.

Essex Project Site

~~17.416~~17.414 Water supply within the region is considered to be under water stress, however ESW have confirmed that they have capacity to supply and meet the Essex Project Site's potable water demands. Any new development will be expected to meet the requirements for water efficiency and demand management that will be brought forward in the ESW Water Resource Management Plan.

~~17.417~~17.415 Given ESW's assurances of capacity within their system, it is considered the magnitude of change on strategic water supply (high sensitivity) could be minor and the magnitude of effect **minor adverse**.

Foul water drainage

~~17.418~~17.416 Where new foul connections are poorly timed or made to areas with limited capacity, the building of new developments can cause complications as pollution can accumulate in another location along the sewerage catchment. Abstraction locations can be affected, and the local sewer network can discharge prematurely, or the wastewater treatment works that serve the area may not meet the required limits that prevent pollution in that location.

Kent Project Site

~~17.419~~17.417 SW have stated that they do not have capacity at their Northfleet WWTW to manage foul water from the Kent Project Site, nor is it within their 2025-2030 Business Plan. As a result, foul water from the Kent Project Site will be managed through a bespoke WWTW to be located on-site, in the ~~most likely in the~~ northern area of the peninsula where the leachate plant is currently located.

17.418 ~~At the time of writing, the proposed new WWTW has not been designed, but~~The WWTW is being designed to have sufficient capacity to manage all anticipated future foul demand from the site ~~will be ensured~~ with appropriate storage provided. ~~.~~

~~17.420~~17.419 ~~-~~Design parameters and constraints for the on-site WWTW and discharge of treated effluent into the Thames River or for reuse, require co-ordination and agreement with the Environment Agency and Port of London Authority, among other stakeholders. It is anticipated that EA approval will be achieved through ~~this will undertaken via~~ the Environmental Permitting process.

~~17.421~~17.420 Considering the bespoke approach to managing foul water from the Kent Project Site, ensuring capacity is sufficient to meet forecast foul generation, the effect significance on both the existing foul sewerage network (moderate sensitivity) as well as the proposed WWTW (low sensitivity) infrastructure is envisaged to be **negligible**.

Essex Project Site

~~17.422~~17.421 While there will be a slight increase in foul water drainage volumes from the site – estimated at approximately 12 m^3/day – AW has confirmed that it a direct connection into its existing wastewater network can be made and there is capacity for treatment at Tilbury Water Recycling Centre. The magnitude of change is considered small and the effect significance on foul water services infrastructure (moderate sensitivity) considered **minor adverse**.

Scour, erosion and accretion impacts

~~17.423~~17.422 There is the potential for scour, erosion and accretion impacts as a result of a change to the hydrodynamic regime, from localised effects to impacts across wider scales.

~~17.424~~17.423 Scour impacts are expected to be localised and may result from unrestricted surface water discharge into the River Thames from both Kent and Essex Project Sites as well as potential discharge of treated effluent from the proposed WWTW at the Kent Project Site, which could disturb the river bed and redistribute sediment.

~~Dredging, if necessary, will be limited to areas in the vicinity of existing and planned wharves and piers. It will not need to be carried out near flood defence infrastructure, and therefore no erosion impacts from dredging are envisaged.~~

17.424 Vessel wash impacts could also potentially erode areas of riverbank – particularly around berthing areas where traffic is highest.

17.425 Creation of the NAABSA berth allowing vessels to sit on the riverbed at low tide requires a level riverbed and so periodically a maintenance tug will re-level the bed by pulling a bar across it. This will create a short-term disturbance to the settled sediment of the river, but it does not involve removal or addition of material.

Kent Project Site

17.426 Surface water on the Kent project Site will be conveyed into the two marsh areas and constructed wetland through new outfalls with non-return valves. It will discharge from there to the River Thames via new culvert outfalls.

17.427 In terms of the WWTW, there are different options for means of discharge of treated effluent into the River Thames, including a discharge pipe form the shore into the river and a discharge channel into the river. At the time of writing, the preferred option is a channel outfall. Regardless of which option, scour impacts on the riverbed are a risk.

17.428 The outfalls from the development site to the marshes and from both the WWTW and the marshes/constructed wetland to the River Thames, if unmitigated, could result in scour of marshes/river. In addition, vessel wash could cause erosion along riverbanks. Considering the sensitivity of hydromorphology in the River Thames (high sensitivity) and marshland areas, and a magnitude of change which could be up to medium adverse, the effect significance is considered **major adverse** in the absence of further mitigation.

~~17.426~~17.429 The levelling of the NAABSA berth, carried out periodically, is not anticipated to result in any impact on the water regime or water quality.

Essex Project Site

~~17.427~~17.430 A new outfall to River Thames is proposed to discharge surface water runoff from the Essex Project Site, if the existing outfall is not considered suitable. Outfall will be restricted based on tidal levels, but scour impacts of the riverbed and bank are possible. Vessel wash causing erosion impacts to river banks is also a possibility depending on vessel type. Considering the sensitivity of hydromorphology in the River Thames (high sensitivity), and a magnitude of change which could be up to medium adverse, the effect significance is considered **major adverse** in the absence of further mitigation.

PROPOSED MITIGATION

~~17.428~~17.431 An Outline Construction Environmental Management Plan (CEMP) has been submitted as part of the DCO application, appended to Chapter 3 of the ES. It includes mitigation measures to protect the water environment and provides an outline of how construction activities will be undertaken in accordance with good practice guidance. Of particular relevance to water resources are the Pollution Prevention Guidelines (PPG) formerly published by the EA (and now available in the National Archives), particularly 'PPG1 General guide to the prevention of water pollution', 'PPG2 Above ground oil storage tanks', 'PPG5 Works in, near or liable to affect watercourses', and 'PPG6 Working at construction and demolition sites', and other good construction guidance such as CIRIA 'Guidance C532 - Control of water pollution from construction sites'.

~~17.429~~17.432 The appointed contractor should develop a detailed CEMP, building on the principles of the Outline CEMP and incorporate mitigation and enhancement measures to ensure the water environment is protected as site preparation and construction moves forward. This can be secured through planning condition.

Demolition and construction mitigation

~~17.430~~17.433 Measures relating to water resources and flood risk that are included in the Outline CEMP include:

Water demand

~~17.431~~17.434 All relevant contractors should investigate opportunities to minimise and reduce the use of water, such as:

- Selection and specification of water efficient equipment;
- Implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both onsite and within site offices;
- Use of recycling water systems such as wheel washes, site toilets handwash; and
- Use of a rainwater harvesting system for use in equipment and vehicle washing.

Management of sediment loads

~~17.432~~17.435 The following measures should be implemented:

- Keep gradients of soil as shallow as possible to prevent large amounts of earth being washed away during periods of heavy rainfall. Areas which are exposed should be reseeded or surfaced as soon as practicable.
- Enforce tight control of site boundaries including minimal land clearance and restrictions on the use of machinery adjacent to water bodies. Where possible, do not locate stockpiles within 10 m of water bodies or drainage lines.
- Wheel wash facilities should be provided at all entry and exits points. Water from wheel wash facilities must not be discharged directly into water bodies or the on-site surface water sewerage network.
- Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water

body or the on-site surface water sewerage network.

- Sediment should be removed from water pumped during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent.

- In order to reduce the impacts to the marine bed floating equipment should be utilised where possible, such as float top barges with drilling rigs attached.

- Dust suppression measures such as dampening, and wheel washing.

Release of hydrocarbons and oils

~~17.433~~17.436 The following measures should be implemented:

- Incorporation of interceptors where appropriate into the site drainage system at high risk areas, such as parking, unloading and refuelling areas, to remove hydrocarbons and oils from surface water prior to discharge.

- Other measures including drip trays under equipment such as generators, and wheel washing facilities should also be implemented to minimise the risk of pollutants infiltrating groundwater or the surface water drainage network.

Leaks and spillages of hazardous materials

~~17.434~~17.437 The following measures should be implemented:

- Provision of storage facilities and tanks and conduct refuelling of machinery within bunded areas, which should not be located within 10 m of water bodies or drainage lines.

- Storage and bunded areas to be constructed of impervious floors and walls with the capacity for the contents of the storage tank and an additional ten per cent safety margin.

- As a remedial measure, spill containment equipment such as absorbent materials should be stored on-site.

- Mixing of construction materials, such as cement, will be conducted in designated areas located away from water bodies and drainage lines.

Maintenance of temporary sewerage systems

~~17.435~~17.438 The following measures should be implemented:

- Provision and maintenance of temporary septic tank, cesspit and/or sewerage connection for disposal of sewage from the toilet facilities to reduce the likelihood of crude sewage infiltrating groundwater or migrating towards water bodies.
- Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies / on-site culverts.

Wind-blown dust and debris

~~17.436~~17.439 The following measures should be implemented:

- Damping down to suppress the creation of dust.
- Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.

Dewatering of excavations

~~17.437~~17.440 The following measures should be implemented:

- Capture run-off from the Project Site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network.
- Sediment should be removed from pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent.
- If there is a requirement for discharge to the combined sewer, this should be throttled to a flow rate that is agreed with the water authority prior to commencement of work.

Direct pollution and/or disturbance of sediment in the River Thames as a result of marine infrastructure works

~~17.438~~17.441 The following measures should be implemented:

- Work carried out in line with a detailed construction methodology in accordance with the Construction Method Statement (appended to Chapter 3 of the ES) (document

reference 6.2.3.1) and in line with relevant measures set out in the FRA (Appendix 17.1) (document reference 6.2.17.1).

- Detailed method statement to be developed and agreed with EA (this is also likely to be applicable to works on site when removing/diverting water bodies, and any appropriate permitting approvals will need to be agreed with the EA).

Flood risk to site workers during construction

~~17.439~~17.442 The following measures should be implemented:

- Principal Contractor to prepare a live Flood Warning and Management Plan including arrangements to make safe any plant, consideration of appropriate action to suit the level of flood warning, and any associated risk of working near water.
- All earthworks below groundwater must adopt appropriate pollution control measures in accordance with EA guidance.

Operational Mitigation

~~17.440~~17.443 The following commitments, which are represented within the FRA and drainage strategies for this DCO application are considered to form embedded mitigation. The subsequent assessment assumes that the design measures specified in these documents are implemented.

Pollutants from river vessels

~~17.441~~17.444 The following measures should be implemented:

- No spillage of fuel or overfilling when refuelling;
- Ensure portable tanks on boats are secure;
- Careful disposal of waste oils and used filters from boats;
- All vessels fitted with adequate holding tank for sewage and waste water;
- Drip trays under the engine and gearbox to prevent oil entering bilge and emptied regularly; and
- Diversification of fleet to hybrid and/or electric river vessels.

Water demand

~~17.442~~17.445 The following water demand management requirements are proposed in the water supply strategy:

- All buildings to be installed with efficient water fittings and fixtures such as low-flush toilets, spray taps and low-flow showers;
- Greywater systems considered for hotels, offices and residential apartment blocks for re-use in toilet flushing;
- Capture, treatment and re-use of water supplied and used for all water rides and other rides in the theme park;
- Low maintenance planting for landscaped areas to minimise water demands post-establishment;
- Rainwater harvesting for landscape irrigation and other non-potable uses (cleaning etc);
- SMART metering for early identification of leakage; and
- Management of stress on external networks (where required and viable) through on-site storage.

Surface water pollution

~~17.443~~17.446 Sustainable drainage systems such as green roofs, dry swales, wetlands, pond, oil interceptors or permeable pavements are proposed where possible to capture and remove pollutants from surface water runoff before discharge to the River Thames or River Ebbsfleet. These systems have been designed following the Simple Index Method as described in The SuDS Manual, CIRIA C753. The design will be refined further during design development.

~~17.444~~17.447 Pollutant interceptors should be proposed within the areas with vehicle access, in order to remove hydrocarbon pollutants from road run off and should be located at the discharge from each catchment. Siltation controls may also be installed if it is found that an additional level of treatment is required.

~~17.445~~17.448 A maintenance regime for the proposed SuDS components will be prepared at the next stage of design to ensure the features perform as intended and risk of pollution of the receiving water bodies is reduced.

~~17.446~~17.449 In terms of pollution from river transport, the following measures should be adopted:

- Careful and appropriate disposal of waste oils and used filters;
- Monitoring of bilge water for contaminants;
- Use of low-sulphur fuels;
- Littering controls for passengers;
- Limiting speeds where possible.

~~17.447~~17.450 The use of electric-powered boats should be considered, with a strategy for expanding electric boat use as soon as is feasible.

Scour, erosion and accretion

~~Scour protection measures will be incorporated to reduce the risk of scour at the outfall location and where vessel wash could erode banks, such as concrete aprons, gabion matts or other solutions that suit each setting and discharge conditions.~~

17.451 An outfall pipe can be designed to avoid scour in several ways. One is to select a multiport diffuser. This is essentially a pipe with small discharge ports projecting radially. Effluent leaves the pipe via these small outlets and is dispersed in the water body. The diffusers are arranged to avoid scouring the bed around the pipe and the discharge velocity is controlled to ensure scour velocities are avoided. An alternative is to have an outfall with a single discharge port angled upward and away from the riverbed or horizontally into the water body. This can also be fitted with a diffuser to aid dispersion.

~~17.448~~17.452 In addition, measures will ~~should~~ be incorporated to reduce the risk of scour where vessel wash could erode banks as well as at outfall locations. Measures could include, ~~such as~~ concrete aprons, gabion matts, wave wash booms, or other solutions that suit each setting and discharge conditions.

RESIDUAL ENVIRONMENTAL EFFECTS

~~17.449~~17.453 If the aforementioned mitigation measures are implemented, along with good site practice, the residual demolition and construction impacts to the water environment are considered to be no more than **minor adverse** and temporary for the duration of the demolition and construction period.

~~17.450~~17.454 Likewise, if the mitigation measures outlined are implemented during operation, then residual effects are likely to be **negligible or minor adverse**.

~~17.451~~17.455 A summary of residual impacts during construction and operation of the Proposed Development is provided in Tables 17.19 and 17.20.

Table 17.19: Summary of residual effects during construction

Receptor	Effect	Significance before mitigation	Mitigation	Residual effect significance
Kent Project Site				
River Thames	Increased sediment loads	Major adverse	Implementation of a CEMP. Do not locate stockpiles within 10 m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exits points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures which are typically implemented for air quality management issues. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies Use of floating equipment where possible to reduce impact to marine bed. Work carried out in line with a detailed construction methodology in accordance with the Construction Method Statement and in line with relevant measures set out in the FRA. River works carried out in	Minor adverse

			controlled, discreet lengths. Detailed method statement to be developed and agreed with EA.	
	Hydrocarbons and oils	Major adverse	Implementation of a CEMP. Incorporate interceptors into the site drainage system at high risk areas. Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse
	Accidental leaks of hazardous materials	Major adverse	Implementation of a CEMP Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse
	Dust and debris	Major adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Minor adverse
	Leak and breakage of the temporary sewerage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection. Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies / on-site culverts.	Minor adverse
	Dewatering of excavations	Major adverse	Capture run off from site in perimeter cut off	Minor adverse

			ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network. Sediment should be removed from water pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the combined sewer, this should be throttled to a flow rate that is agreed with Thames Water prior to commencement of work.	
River Ebbsfleet	Increased sediment loads	Major adverse	Implementation of a CEMP. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exits points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures which are typically implemented for air quality management issues	Minor adverse

			Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies	
	Hydrocarbons and oils	Major adverse	Implementation of a CEMP. Incorporate interceptors into the site drainage system at high risk areas Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse
	Accidental leaks of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse
	Dust and debris	Major adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Minor adverse
	Leak and breakage of the temporary sewerage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection. Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies / on-site culverts.	Minor adverse

	Dewatering of excavations	Moderate adverse	Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network. Sediment should be removed from water pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the combined sewer, this should be throttled to a flow rate that is agreed with Thames Water prior to commencement of work.	Minor adverse
Black Duck and Botany Marshes (including Swanscombe Channel)	Increased sediment loads	Major adverse	Implementation of a CEMP. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exits points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures which are typically implemented for	Minor adverse

			air quality management issues. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	
	Hydrocarbons and oils	Major adverse	Implementation of a CEMP. Incorporate interceptors into the site drainage system at high risk areas Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse
	Accidental leaks of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse
	Dust and debris	Major adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Minor adverse
	Leak and breakage of the temporary sewerage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection. Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies	Minor adverse

			/ on-site culverts.	
Sawyer's Lake	Dust and debris	Moderate adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Minor adverse
Castle Hill Lake	Dust and debris	Moderate adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Minor adverse
Water services infrastructure (supply)	Increased water demand	Major adverse	Implementation of a CEMP. All relevant contractors should investigate opportunities to minimise and reduce the use of water, such as: selection and specification of equipment; implementation of staff-based initiatives such as turning off taps, plant and equipment when not in use both onsite and within site offices; use of recycling water systems such as wheel washes, site toilets handwash; and use of a rainwater harvesting system for use in equipment and vehicle washing.	Minor adverse
Site users	Flood risk to demolition/construction workers and construction plant	Moderate adverse	Contractor to prepare a flood emergency and contingency plan including arrangements to make safe any static plant, move any mobile plant, and to evacuate site operatives in a flood risk emergency. Construction workers	Negligible

			should be made aware of risks associated with excess surface water caused by overland flows and standing water.	
Essex Project Site				
River Thames	Increased sediment loads	Major adverse	Implementation of a CEMP. Do not locate stockpiles within 10m of water bodies or drainage lines. Wheel wash facilities should be provided at all entry and exits points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures which are typically implemented for air quality management issues. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies Use of floating equipment where possible to reduce impact to marine bed. Work carried out in line with a detailed construction methodology in accordance with the Construction Method Statement and in line with relevant measures set out in the FRA. River works carried out in controlled, discreet lengths. Detailed method statement to be developed and agreed	Minor adverse

			with EA.	
	Hydrocarbons and oils	Major adverse	Implementation of a CEMP. Incorporate interceptors into the site drainage system at high risk areas. Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse
	Accidental leaks of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	
	Dust and debris	Major adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping down to suppress the creation of dust.	Negligible
	Leak and breakage of the temporary sewerage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection. Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies / on-site culverts.	Negligible
East Tilbury Dock Sewer	Increased sediment loads	Major adverse	Implementation of a CEMP. Do not locate stockpiles within 10m of water bodies or drainage lines.	Minor adverse

			Wheel wash facilities should be provided at all entry and exits points. Run-off and dewatering will be settled in temporary lagoons before discharge. Apply dust management procedures which are typically implemented for air quality management issues. Implement good site practice, perimeter fences and tight control of materials and waste to minimise the risk of debris entering water bodies.	
	Hydrocarbons and oils	Major adverse	Implementation of a CEMP. Incorporate interceptors into the site drainage system at high risk areas Use of drip trays under equipment such as generators and wheel washing facilities.	Minor adverse
	Accidental leaks of hazardous materials	Major adverse	Implementation of a CEMP. Provide storage facilities and tanks and conduct refuelling of machinery within bunded areas away from water bodies and drainage lines. Mixing of construction materials will be conducted in designated areas located away from water bodies and drainage lines.	Minor adverse
	Dust and debris	Major adverse	Apply dust management procedures which are typically implemented for air quality management issues, such as damping	Minor adverse

			down to suppress the creation of dust.	
	Leak and breakage of the temporary sewerage system	Major adverse	Contractor should provide and maintain temporary septic tank, cesspit and/or sewerage connection. Any temporary toilet facilities will be positioned at least 10 m away from the banks of water bodies / on-site culverts.	Minor adverse
	Dewatering of excavations	Major adverse	Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network. Sediment should be removed from water pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the combined sewer, this should be throttled to a flow rate that is agreed with Thames Water prior to commencement of work.	Minor adverse
Pincock's Trough	Dust and debris	Minor adverse	Apply dust management procedures which are typically implemented for air quality management	Negligible

			issues, such as damping down to suppress the creation of dust.	
Water services infrastructure (surface water)	Dewatering of excavations	Moderate adverse	Capture run off from site in perimeter cut off ditches, settlement lagoons and/or settlement tanks where possible. Any dewatering required from site excavations should be pumped into a settlement tank or lagoon and not discharge direct to a water body or the on-site surface water sewerage network. Sediment should be removed from water pumped water during any extractions required. Sediment should be removed prior to discharges to the surface water network through the use of a baffle tank system or equivalent. If there is a requirement for discharge to the combined sewer, this should be throttled to a flow rate that is agreed with Thames Water prior to commencement of work.	Negligible
Water services infrastructure (supply)	Increased water demand	Moderate adverse	Implementation of a CEMP. All relevant contractors should investigate opportunities to minimise and reduce the use of water, such as: selection and specification of equipment; implementation of staff-based initiatives such as turning off taps, plant and	Negligible

			equipment when not in use both onsite and within site offices; use of recycling water systems such as wheel washes, site toilets handwash; and use of a rainwater harvesting system for use in equipment and vehicle washing.	
Site users	Flood risk to demolition/construction workers and construction plant	Moderate adverse	Contractor to prepare a flood emergency and contingency plan including arrangements to make safe any static plant, move any mobile plant, and to evacuate site operatives in a flood risk emergency. Construction workers should be made aware of risks associated with excess surface water caused by overland flows and standing water.	Negligible

Table 17.20: Summary of residual effects during operation

Receptor	Effect	Significance before mitigation	Mitigation	Residual effect significance
Kent Project Site				
River Thames	Pollutants contained in surface water	Minor beneficial	Water quality measures already committed to as summarised above and included in 'Pollution control' sections of the Drainage Strategy.	Minor beneficial
	Pollutants released from river vessels	Major adverse	No spillage of fuel or overfilling when refuelling; Ensure portable tanks on boats are secure; Careful disposal of waste oils and used filters from boats; All vessels fitted with	Minor adverse

			adequate holding tank for sewage and wastewater; Drip trays under the engine and gearbox to prevent oil entering bilge and emptied regularly; and Diversification of fleet to hybrid and/or electric river vessels.	
	Scour, erosion and accretion	Major adverse	Scour protection measures will be incorporated to reduce the risk of scour at the outfall location such as concrete aprons, gabion matts, wave wash booms or other solutions that suit each setting and discharge conditions. A multiport diffuser could be incorporated into the outfall pipe which disperses effluent in the water body to avoid scouring. Alternatively, an outfall with a single discharge port angled upward and away from the riverbed or horizontally into the water body could be employed. This can also be fitted with a diffuser to aid dispersion.	Minor adverse
River Ebbsfleet	Pollutants contained in surface water	Minor beneficial	Water quality measures already committed to as summarised above and included in 'Pollution control' sections of the Drainage Strategy.	Minor adverse
Broadness, Black Duck and Botany Marshes (including	Pollutants contained in surface water	Minor beneficial	Water quality measures already committed to as summarised above and included in 'Pollution control' sections of the	Minor adverse

Swanscombe Channel)			Drainage Strategy.	
Water services infrastructure (supply)	Increase in potable water demand	Major adverse	Continued early engagement with TW on the water needs for the Proposed Development and any current restrictions and the need for any upgrades. Water efficiency measures through design as well as further detail on stored water options as strategy progresses.	Minor adverse
Water services infrastructure (foul)	Decrease in demand on foul drainage network	Negligible	N/A	Negligible
Site users	Change to on-site flood risk	Negligible	N/A	Negligible
Off-site users and residents	Change to off-site flood risk	Negligible	N/A	Negligible
Essex Project Site				
River Thames	Pollutants contained in surface water	Negligible	Water quality measures already committed to as summarised above and included in 'Pollution control' sections of the Drainage Strategy.	Negligible
	Scour, erosion and accretion	Major adverse	Scour protection measures will be incorporated to reduce the risk of scour at the outfall location such as concrete aprons, gabion matts or other solutions that suit each setting and discharge conditions.	Negligible
Water services infrastructure (supply)	Increase in potable water demand	Minor adverse	Measures already committed to as part of the Utilities Strategy	Minor adverse
Water services infrastructur	Increase in demand on foul drainage network	Minor adverse	Measures already committed to as part of Drainage Strategy	Minor adverse

e (surface water)				
Site users	Change to on-site flood risk	Negligible	N/A. No further mitigation required, beyond Flood Risk Assessment commitments.	Negligible
Off-site users and residents	Change to off-site flood risk	Minor adverse	Commitments already made through Flood Risk Assessment.	Minor adverse

~~17.452~~17.456 This assessment, in line with other EIA topics in this DSO application, has considered impacts separately within both the Kent Project Site and the Essex Project Site. Receptors within these two sites are, on the whole, exclusive to each Site, however the River Thames has been included as a sensitive receptor for both sites as it is subject to a number of water resource impacts, from water quality to hydromorphological effects, at each respective Project Site.

~~17.453~~17.457 During the construction phase, residual effects are anticipated to be minor adverse at the Kent Project Site and minor adverse to negligible at the Essex Project Site. The combined effect on the River Thames is considered to be no greater than minor adverse for each of the impacts identified, with the exception of hydromorphology, which is negligible at both sites and considered negligible in combination.

~~17.454~~17.458 During operation, residual effects associated with pollution range from minor beneficial (reduction of pollutants in stormwater runoff) to minor adverse (pollution from river vessels) at the Kent Project Site, and are negligible at the Essex Project Site. Overall, a conservative estimate of minor adverse is considered for pollution impacts on the River Thames.

CUMULATIVE AND IN-COMBINATION EFFECTS

Construction

~~17.455~~17.459 There is potential for cumulative effects during construction with regard to pollutant loading within the River Thames from construction impacts of surrounding developments acting together. This is, however, not expected to be significant so long as compliance and implementation of the mitigation outlined within a CEMP is practiced for each scheme, as will be the case for the Proposed Development at both Project Sites.

~~17.456~~17.460 Water quality within the River Thames during construction is considered to be subject to potentially minor adverse impacts, and the accumulation of similar construction impacts at other riverside developments both upstream and downstream could result in a combined larger magnitude of impact. However, if measures in each respective ES are carried forward into a CEMP during construction, impacts are considered to remain non-significant.

Operational

~~17.457~~17.461 As standard, surrounding residential and industrial cumulative developments will discharge surface water into a combined sewer network or directly to the River Thames. As the Proposed Development at the Kent Project Site will discharge surface water to the River Thames, no adverse cumulative effect on drainage infrastructure is expected as a result of the Proposed Development. Combined water quality impacts on the River Thames are not considered to be significant as drainage implementation in line with the NPPF on Project Site as well as surrounding cumulative scheme sites, and the implementation of SuDS in line with respective GLA and local authority policies will in turn support the improvement of water quality and help the Middle River Thames meet 'Good' waterbody quality in line with WFD targets.

~~17.458~~17.462 The details of the water supply strategy for the Kent Project Site are not fully developed. Ongoing engagement with Thames Water will refine the strategy. The strategy will take into account the impact on surrounding schemes and users, most significantly, due to its scale, the demand of Ebbsfleet Garden City to the west of the site.

CLIMATE CHANGE

~~17.459~~17.463 The construction period is planned to last until 2024 for Gate 1 and 2029 for Gate 2. Climate forecasts show that as a result of climate change, the south-east of England is likely to experience slightly wetter winters and drier summers. Whilst there are not likely to be significant changes to precipitation levels in the timeframe of the construction of this development, climate change is also likely to result in more extreme weather events, such as extended periods of heavy rain which are becoming more frequent and could result in flash flooding.

~~17.460~~17.464 Based on the current climate forecasts during the construction period, there is not a need for specific adaptation measures to reduce the risk from climatic effects during construction. There may be an increased risk of extreme weather events, and prudence must be made during construction to be aware of local forecasts and allow flexibility in the approach to construction work as appropriate at the time, however specifying adaptation measures at this stage is not deemed necessary.

~~17.461~~17.465 Over the operational period, climate forecasts based on UKCP18 data show that as a result of climate change, the south east of England is likely to experience mean temperature increases of approximately 5 degrees C in the summer months scenario, and approximately 3 degrees C in winter months, under a high emissions scenario. In addition, significant annual mean precipitation changes are likely with winter months potentially becoming wetter and summer months, while variable, more likely to be drier. This could make the development increasingly vulnerable to extreme weather events such as flash flooding and heavy rain.

~~17.462~~17.466 The flood risk modelling undertaken in this assessment incorporates higher-risk

climate change scenarios, and the design of the Proposed Development includes measures to manage predicted changes to flood risk and surface water flows with these future conditions considered.

~~17.463~~17.467 A hotter drier climate will increase pressure on ground water sources and increase water supply stress across both Project Sites. Engagement with Thames Water and Essex and Suffolk Water will continue to ensure sustainable solutions for meeting water demand throughout the lifetime of the Project.

SUMMARY AND CONCLUSIONS

~~17.464~~17.468 The assessment of Water Resources and Flood Risk impacts has considered the impact of the following water elements:

- Flood risk management;
- Surface water drainage
- Foul drainage;
- Water resource management;
- Water quality and commitments to the Water Framework Directive (WFD); and
- Changes to hydrodynamics, sedimentation and erosion.

~~17.465~~17.469 Impacts relating to these elements have been assessed separately for both the Kent Project Site and the Essex Project Site. Combined effects on the River Thames – a common receptor at both Sites – has also been considered.

~~17.466~~17.470 The assessment considers that significant impacts will arise from both the demolition and construction phase and the operation phase of the Proposed Development without appropriate mitigation measures.

Demolition and Construction

~~17.467~~17.471 The site has pre-existing water contamination issues due to its past and current uses including landfill, leachate treatment and general environmental condition of the peninsula and its marshlands. Construction processes will introduce a new set of environmental pressures and impacts as assessed in this chapter. Through best-practice approach to the demolition and construction process as well as through supplementary mitigation measures to be included in the CEMP, it is considered that residual effects can be kept to non-significant levels across both sites. For the Essex Project Site, these range from negligible to minor adverse. For the Kent Project Site, which generally has larger magnitudes of impact, these are considered minor adverse for impacts to water quality and flood risk. Combined effects of demolition and construction at both sites on the River

Thames are considered minor adverse assuming the approach and mitigation measures specified are implemented.

~~17.468~~17.472 A Hydrodynamic and Sedimentation Assessment has also been carried out and the results have been used to assess the impact of potential changes of the marine infrastructure and coastal/riverbank conditions on the River Thames hydromorphology. While some minor changes to flow speeds, sedimentation rates and deposition areas have been identified, these are considered negligible in the context of the general regime of the river and will not create any significant impacts.

Operation

~~17.469~~17.473 In terms of impact on water receptors, the operational development should see an improvement to water quality as a result of pollution control measures proposed in the surface water drainage strategy, and upgrades to the leachate management facilities on the Kent Project Site. Improvements are also made to flood management infrastructure, but a conservative approach to assessment has been taken, and since higher sensitive receptors are being introduced on site, the effect significance at the Kent Project Site with respect to the Main Resort is left at negligible.

~~17.470~~17.474 Wastewater on the Kent Project Site is currently discharged into the foul sewerage network. As Northfleet WWTW does not have the capacity to manage all foul discharge during the operational phase, it is proposed that a WWTW will be constructed on-site to manage foul water from the Proposed Development. This may increase the capacity of the current sewerage infrastructure, though this is not considered significant. Details of operation and discharge from the proposed WWTW will be agreed with the EA as the design progresses.

~~17.471~~17.475 The only residual significant impact identified with respect to water resources and flood risk, is a potential impact on water demand at the Kent Project Site once the Proposed Development is operational. Based on the current potable water demand profile for the Site, this is considered a minor adverse impact, considering that solutions that are being explored through engagement with Thames Water to consider how, through water storage and demand minimisation measures, potable water demand can be met.